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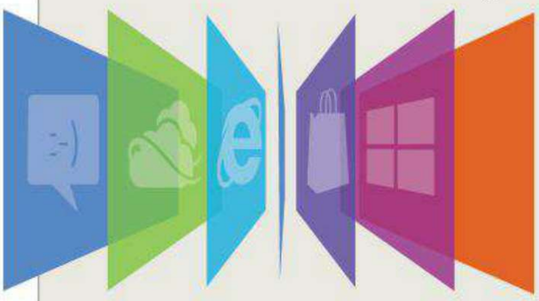

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Michael
Brown

BUILDING: IT GETS INTO YOUR BLOOD

BUILD YOURSELF a new computer and never again will you be satisfied with one of those mass-produced, designed-for-all, good-for-no-one-in-particular boxes.

Now I'm as impressed as the next geek by the uber rigs that emerge from many of the high-end boutique PC shops, but there's no way I could afford to actually *buy* that much bling—certainly not on a journalist's salary.

Armed with a little know-how, no-nonsensse buying advice, and reasonable finances, however, I can build a system—or upgrade the one I already have—that will deliver comparable performance.

And that's exactly what you'll find in this special edition of *Maximum PC* (aside from the finances, of course; you're on your own on that score).

I couldn't begin to guess how many computers this magazine's collective editorial staff has built over the years, but if you can imagine it, we've done it: Gaming rigs; home-theater PCs; audio-, photo- and video-editing workstations; home servers; NAS boxes; and a whole lot more.

If you're at the newsstand wondering if this magazine is worth your hard-earned cash, take a moment to leaf through the pages and see just how much useful information we've crammed into this special edition: If you can find a better computer rag out there, buy it!

Curious about Windows 8? You'll find the definitive review of Microsoft's new operating system on page 6, hands-on reviews of the latest Windows 8 peripherals on 42, and a how-guide explaining how you can restore your favorite Windows administrator's tools on page 94.

Craving a free alternative to those ubiquitous Microsoft operating systems? Turn to page 74 and allow us to show you how to get up and running with Linux. Install Steam and you'll discover a massive collection of fun, fantastic, and incredibly inexpensive games!

Whether you're building a new machine or upgrading an old one, our "Best Bang for the Buck" feature, starting on page 34, will guide you to the videocards, coolers, CPUs, and other components that we think deliver the best price-performance ratios today.

When you've finished your build, turn to page 58 and we'll show you the best way to break in your brand-new baby.

Happy building!

Michael Brown is a long-time contributor to Maximum PC.

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WINDOWS 8:

MICROSOFT STRAPS A TABLET OPERATING SYSTEM TO WINDOWS 7 AND TICKS ITS NUMBER UP A NOTCH. SHOULD ENTHUSIASTS MAKE THE BIG UPGRADE?

BY DAVID MURPHY

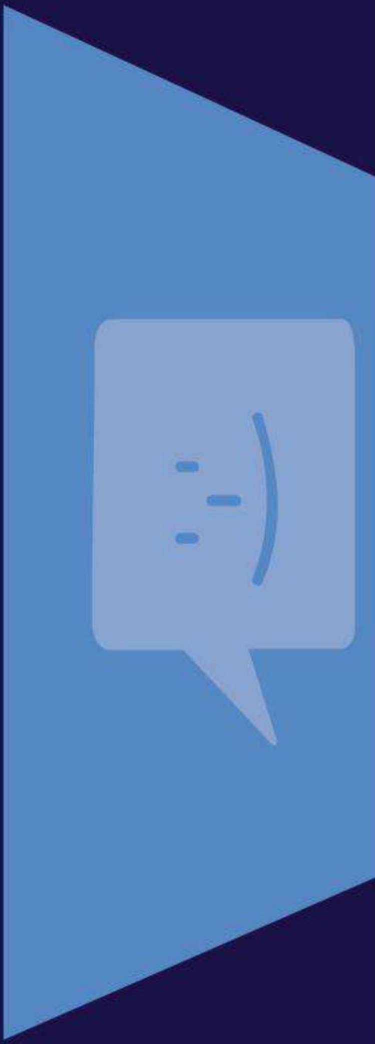
Microsoft's Windows 8 is not a want, it's a necessity. Not for you, the consumer. For Microsoft.

We'd like to think that somewhere, somehow, a group of user interface experts like to meet up for lunch in one of Microsoft's (likely) sprawling Redmond cafeterias. They talk about their days, their families, and how horrified they are at Microsoft's decision—and need—to unify a single user experience across its entire product line.

That's the real reason why Windows 8 looks and feels like a tablet operating system slapped overtop Windows 7 (with a few tweaks here and there). It is. Users are given no way around it—Microsoft has made sure of that fact. And, in many ways, there's no way around it for Microsoft, either. The company has decided that users cannot have dissimilar Windows experiences across desktops, tablets, smartphones, or any other kooky gadgets on the horizon, but refuses to (or just can't) cut the cord of the traditional desktop experience just yet.

Windows 8 is the natural, necessary hybrid—the last time you're likely to see the "core" Windows experience of the last decade mashed together with the multicolored, touch-sensitive, "Metro" boxes of the future. A word on that: While Microsoft has elected to not call the tabletized portion of Windows 8's user interface Metro—it's now just called "Windows 8"—we'll keep using the old nomenclature just to make this review easier to process.

We're willing to bet you'll have many other colorful names for your experience with the new OS.



THE NEW ORDER

THE INSTALLATION

We never thought we'd type the words, "Microsoft has made it easy to install Windows," but there you have it. Your first introduction into Microsoft's latest iteration of Windows comes from the previously laborious process of blanking your hard drive and playing the company's equivalent of 20 questions to install an OS.

Assuming you have a product key—now a requirement to install Windows 8, instead of an after-the-fact input—the installation process looks identical to Windows 7's at first. Once you've set the installer to copy files to your hard drive, Windows 8 is off to the races. A simple, black installation screen gives you pithy updates about what's happening between your installation media and your hard drive. After that, only five prompts require your attention, including one for picking your PC name and your favorite color and three that relate to verifying the settings for the Windows Live ID you'll want to link to your installation.

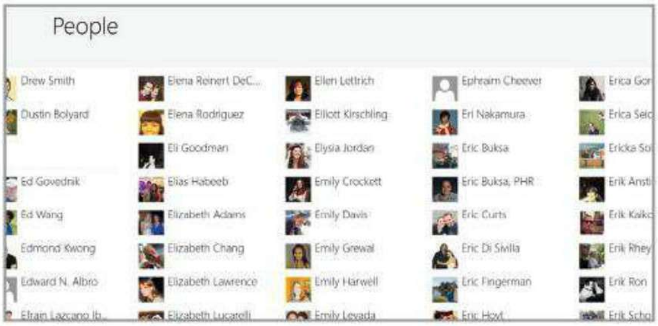
When Windows 8 says, "Your PC will be ready in just a moment," it's not kidding. This is the speediest, most annoyance-free OS installation we've ever experienced.

AND THEN...

Up pops Metro, the tiled-box screen that's easily Windows 8's most controversial feature. To discuss the strengths, weaknesses, and intricacies of Metro alone could eat up an entire multipage review. So we'll lead with the biggie: At its core, Metro feels... undone. To put it another way, Microsoft's treatment of its tiles, Metro's interactions with the "normal" half of Windows 8, and the lack of customization present in this Hyde to Windows 7's Jekyll does a disservice to those who want anything beyond an operating system set in "easy mode."

You, faithful *Maximum PC* readers and computing enthusiasts that you are, will hate Metro.

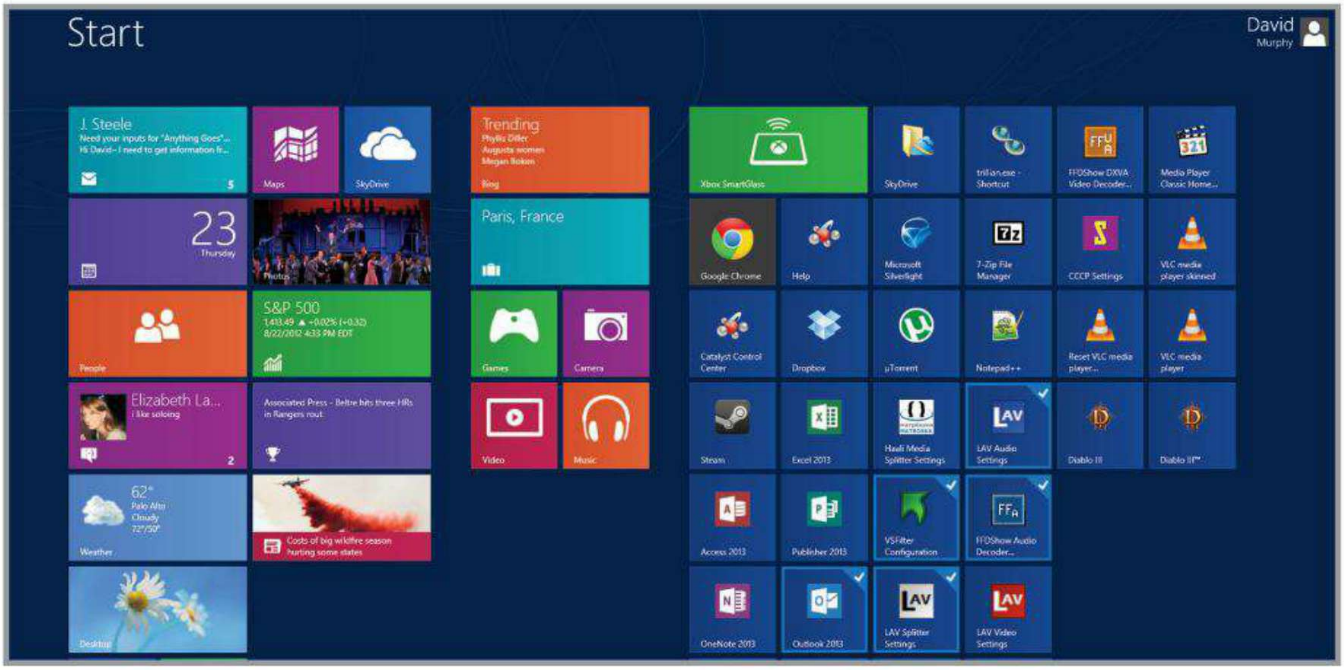
Let's start with the apps. At the time of this review, Microsoft and third-party developers worldwide have yet to jump on the app bandwagon. We can't speak to what's on the horizon for Metro, but we can certainly discuss the apps that come bundled with the operating system by default.


People
Drew Smith
Dustin Bolyard
Ed Govednik
Ed Wang
Edmond Kwong
Edward N. Albro
Efrain Lazcano Ib...
Elena Reinert DeC...
Elena Rodriguez
Eli Goodman
Elias Habeeb
Elizabeth Adams
Elizabeth Chang
Elizabeth Lawrence
Elizabeth Lucarelli
Ellen Lettrich
Elliott Kirschling
Elysia Jordan
Emily Crockett
Emily Davis
Emily Grewal
Emily Harwell
Emily Levada
Ephraim Cheever
Eri Nakamura
Eric Buksa
Eric Buksa, PHR
Eric Curts
Eric Di Sivila
Eric Fingerman
Eric Hoyt
Erica Gor
Erica Seic
Ericka So
Erik Ansti
Erik Kaike
Erik Rhey
Erik Ron
Erik Scho

Metro's People app is a virtual gathering place for just about every contact you'll likely ever have—pulled in from your Google, Twitter, Facebook, LinkedIn, and Microsoft accounts, for now.

The single-app, full-screen Metro environment takes some getting used to. Truly, your capacity to enjoy Microsoft's tablet treatment depends on the app: The People app is as pointless as it is cluttered. We don't understand why one would need to have all of one's contacts—yes, your random Twitter friends too, if you so desire—in a setting that's hard to navigate (horizontal scroll only!), difficult to configure (one giant "news feed" for everyone, really?), and difficult to edit (merging contacts and setting "favorites" takes too long).

SkyDrive? We dare anyone to say that this Metro app is easier to navigate than a simple, Dropbox-like folder in File Explorer (Windows Explorer, no more). Video? Sure, if you like a player that's more in touch with Microsoft's online store than an app that can legitimately play all the files you toss its way. Messaging? Works great with Microsoft Messenger and Facebook—and that's about it. Trillian is hardly shaking in its boots, here.


Start
David
Murphy
J. Steele
Need your inputs for "Anything Goes"...
Hi David—I need to get information fr...
5
Maps
SkyDrive
23
Thursday
Photos
People
S&P 500
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Palo Alto
Cloudy
72°/50°
Weather
Costs of big wildfire season hurting some states
Desktop
Trending
Phyllis Diller
Augusta women
Megan Boken
Bing
Paris, France
Games
Camera
Video
Music
Xbox SmartGlass
SkyDrive
trillian.exe - Shortcut
FFDShow DXVA Video Decoder...
Media Player Classic Home...
Google Chrome
Help
Microsoft Silverlight
7-Zip File Manager
CCCP Settings
VLC media player skinned
Catalyst Control Center
Dropbox
µTorrent
Notepad++
Reset VLC media player...
VLC media player
Steam
Excel 2013
Haali Media Splitter Settings
LAV Audio Settings
Diablo III
Diablo III™
Access 2013
Publisher 2013
VSFilter Configuration
FFDShow Audio Decoder...
OneNote 2013
Outlook 2013
LAV Splitter Settings
LAV Video Settings

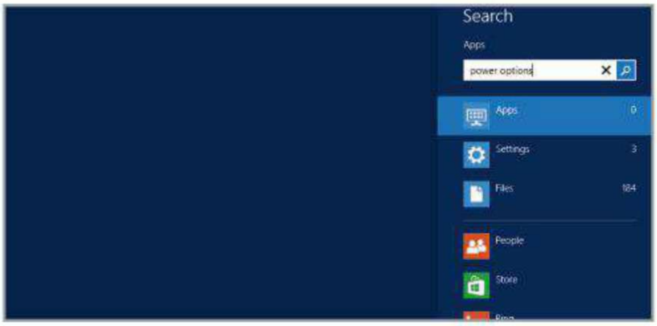
Welcome to Metro—er, make that the Modern UI! Right-click tiles to select them, and then drag them around your desktop to create all new columns—it's a "dumping grounds," of sorts, for groups of programs.

Other apps, like Weather and Maps, deliver a compelling experience within Metro. Games—and the downloadable Xbox Smartglass app—finally tie together one's PC and one's Xbox 360 in a better, but not ideal, fashion. News, though still annoyingly stuck to a horizontal plane, looks as wonderful as its companion app Sports.

Mail, however, is downright laughable—especially when free alternatives like Mozilla's now-dead Thunderbird, the web-based Gmail, or Microsoft's own Outlook application blow its lackluster capabilities out of the water.

It's frustrating that Windows 8's built-in Internet Explorer 10, an app that gets the full Metro treatment to delightful results, requires you to set the browser as your default just to play with its Metro version. Apps like Google's Chrome browser—admittedly still in the development channel as of this article's writing—don't cross-pollinate between Windows Metro and Windows Desktop. Each browser is its own unique instance in this case, which couldn't be any more frustrating for laypeople *and* enthusiasts.

The strength of Windows' apps—both third-party and Microsoft-driven—are going to be the make-or-break elements for Metro. At launch, and especially on a single-screen setup, they are more novelty than necessity.



power options

Metro's search tool, accessible just by typing in anything when you're staring at the main tiles screen, is one of its most compelling features. The now-lamer Windows Indexing of Windows 7 just got put to shame.

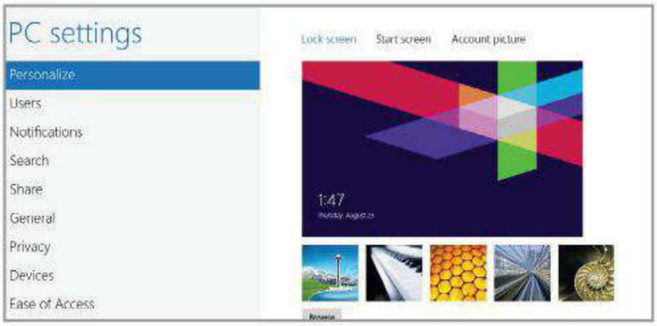
METRO ORGANIZATION

It's possible to think of Metro as simply a start menu—which it basically is, given that Microsoft has killed the traditional Start Menu in Windows 8's desktop mode. Just ignore all the live tiles and downloadable apps and use the blocky UI as a souped-up entry to your desktop. Sort of.

Organizing tiles is as easy as dragging them around to new columns based on whatever internal organization scheme you're going for. That said, it's still annoying that you can't adjust their shape at all, nor edit their size beyond one of two set limits Microsoft has put into place. Microsoft *does* give you the option to assign a name to columns of tiles, but you might miss this feature unless you go hunting (hint: use the lower-right-hand "minus" sign to expand your Metro UI to the full, zoomed-out view, and then right-click a column).

In Metro, a tile is often an app, or a shortcut to an app, that you've pinned to the "Start," though it could also be a folder, library link, or network resource, to name just a few. For whatever reason, you can't create tiles for important "common" files within the Metro interface, like a critical PDF or favorite song you want easy access to.

Windows 8's biggest Metro killjoy occurs when you go to install a new app—like, say, the Combined Community Codec Pack. For Windows 8's Metro interface is, for all intents, its start menu. And when an app like CCC comes with eight or more shortcuts that would otherwise be simple links in said menu, they transform into a whole heckuva lot of tiles within Metro. We can count on one hand the number of times we've needed to delete extraneous or unwanted links on a conventional Windows start menu. Within Metro, you'll be doing this a lot, if you're actually trying to keep your horizontal interface (ugh) clutter-free.



While Metro comes with a number of options to prettify your PC, know that its settings are a wee bit more buried than your average Control Panel—and they aren't even accessible *via* the Control Panel.

To Microsoft's credit, it's wonderful that you can now just type that which you wish to find on your system—from apps, to Windows elements, to files. Metro takes the old and familiar Windows Indexing and kicks it up about five notches. Type in—well, anything—and you'll be able to search for apps that fit your query, Windows settings or prompts, or files. You can even get a little more specific and search *within* apps, like Microsoft's Store, if you already have an idea of what you're looking for and where it might be.

Can you ignore Windows 8's Metro environment and instead pretend that it's just one big, boxy Start Menu? Yes—mostly thanks to Metro's search. However, Microsoft will still do its best to force Metro down your throat by booting to this user interface by default instead of allowing you to jump straight to your desktop. Will you still mostly miss your old Windows 7 Start Menu? We do.

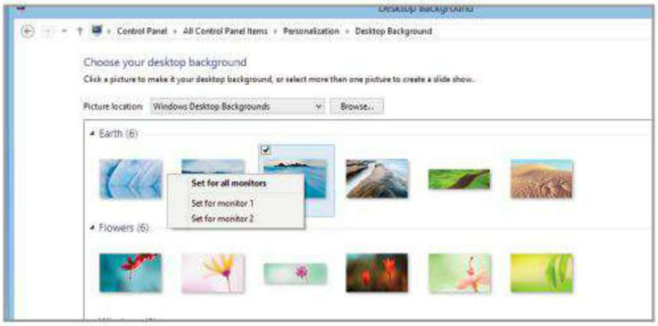
THE MULTI-MONITOR DIFFERENCE

In a single-monitor environment, Metro just doesn't make a lot of sense. As much as Microsoft tries to fit the square peg in the round hole, Metro is, at its core, an interface made for tablets, not a monitor. For a pair of monitors, however, Metro becomes a pretty ideal combination of a standard Windows 7 desktop and a big-ol' screen that you can glance at to view useful information in a blown-up, exaggerated fashion.

In other words, Windows 8 reads a lot better in a multi-monitor setup.

We had the pleasure of being able to try out Windows 8 in such an environment. Better still, our secondary monitor was a handy-dandy ViewSonic touchscreen monitor (for the full Windows 8 Metro experience).

Setting up two monitors is just as easy to do in a Windows 8 environment as it is in Windows 7. For those rocking a touchscreen, however, you'll have to do a bit of jumping around to ensure that your device is perfectly calibrated for your setup. And we don't mean matching your finger-presses to where they register on the panel itself. We had to jump into Windows 8's Tablet PC Settings—of all Control Panel options—to ensure that our finger-presses were correctly mapping to screen number two instead of the primary display. That could not be any more unintuitive on Microsoft's part.


Desktop Background
Control Panel › All Control Panel Items › Personalization › Desktop Background
Choose your desktop background

Click a picture to make it your desktop background, or select more than one picture to create a slide show.

Picture location: Windows Desktop Backgrounds

Browse...
Earth (6)
Set for all monitors
Set for monitor 1
Set for monitor 2
Flowers (6)

Metro's new multi-monitor support means you'll no longer need to turn to third-party apps to manage the funner parts of a dual-screen setup, like setting different wallpapers (or slide shows of wallpapers) on each screen.

It's great that we no longer have to resort to third-party apps to stretch a single wallpaper image across two desktops—thanks, new Windows 8 personalization settings. Even better, Windows 8 now allows you to set custom backgrounds or slide-show wallpapers for each monitor, and you can even flick off the taskbar—or hide it, if no active apps are open on the display—as you see fit.

Keyboard commands allow you to flick windows back and forth between your monitors—nothing new there for Windows 7 multi-monitor enthusiasts. However, what's lacking is a way to force Metro to pop up on a specific monitor via key press or, even better, set a single monitor as the "default" recipient of any Windows key action on your keyboard.

It gets uglier. Metro doesn't just pop up on whatever monitor your mouse cursor happens to be hovering over—that would be too easy. Metro appears on your primary monitor by default. To launch it on a second monitor instead, you first have to hover your mouse in the lower-left-hand corner of the target display and click. After that, Metro will "bind" to your Windows key for that monitor until you repeat the process on a different display.

That's not so bad, right? It gets *uglier*. The basic Metro interface is not a unique entity; it's attached to your normal operating system in such a way that clicking anywhere outside of the interface—like, say, on your primary display—closes Metro entirely. Huh?

You have to launch a Metro app in order for it to "stick" to your second display. After that, all's well—dragging Metro apps back and forth between monitors is as easy as dragging conventional desktop windows to and fro. Metro's snap feature, or the ability to stash a Metro app to a left or right sidebar while you simultaneously operate another app, stays in place when you switch between screens.

We're not sold on Windows 8's touchscreen controls, first and foremost because Microsoft does the barest minimum to explain what they are—and Windows 8 isn't all that intuitive. Second, because you really have to dig into the bezel in order to activate Metro's various "hot corners," which include the options panel you pull up from the bottom of the screen for Metro apps, the right-hand Charms Bar, and the left-hand app-selector sidebar. It would have been a grand gesture if Microsoft gave users the option to adjust the size or sensitivity of the hotspots on their screen. But, hey, at least Windows 8 now supports multitouch gestures on touchpads. Eh?

Another not-so-insignificant annoyance related to a two-monitor setup is that there's no way to get Windows 8 to ignore any touches during inopportune moments. Since Windows 8 treats a tap as if it was a mouse cursor, playing a game full-screen on monitor one while trying to tap your way to an email or a news item

MINIMIZE METRO'S ANNOYANCES

As mentioned, Windows 8's Metro isn't the simplest of interfaces to navigate—especially if you're stuck on a good-ol' keyboard and mouse. However, there are still a few tricks you can use to streamline and customize your way through (or around) Microsoft's "tablet" portion of the OS.

For starters, make sure you fire up Windows' Default Programs app—found by typing "default" into the Metro UI—and use it to set Windows Photo Viewer and Windows Media Player as the default apps for all file types they can open. This allows you to bypass the annoyance of jumping into Metro Photos or Video whenever you click on a related file in File Explorer.

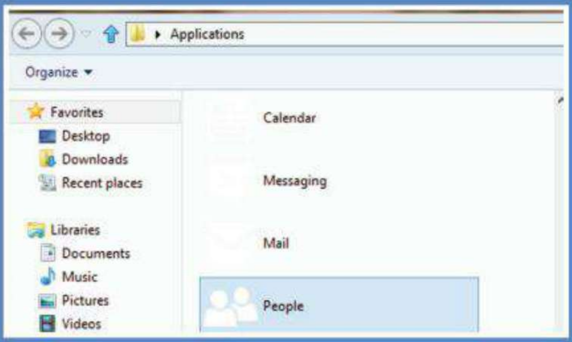
If you want to avoid Windows 8's app management entirely, don't pin your most-used apps as Metro tiles; pin them to your taskbar. The bottom of your desktop screen might get a little cluttered, but at least you won't have to hunt down your apps within Metro.

One of our favorite tricks allows you to bypass having to jump into Metro from the desktop to run Metro apps. Make a shortcut on your desktop and type this in for the item location: **%windir%\explorer.exe shell:::{4234d49b-0245-4df3-b780-3893943456e1}**

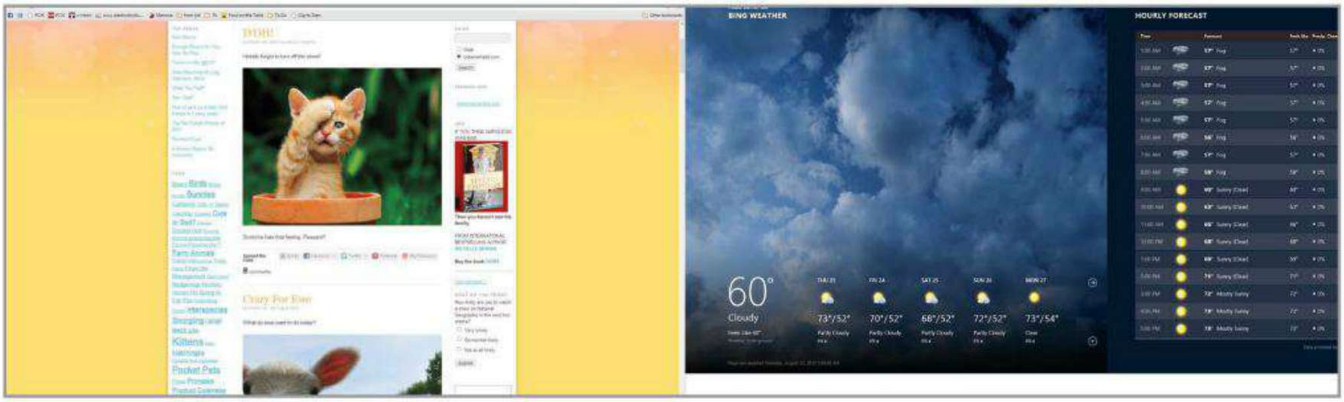
Your shortcut will pull up Windows 8's Applications window, which will let you launch Metro apps directly from the desktop.

For a more intense Metro transformation, check out the third-party app Classic Shell (classicshell.sourceforge.net). Not only can you bring the long-lost Start Menu back into Windows 8, but you'll also be able to boot directly to Windows 8's desktop instead of its Metro UI. Additionally, you can also completely disable a number of portions of the Windows 8 Metro UI: Hotspots, the Charms Bar, etc.

Windows 8 also includes a number of useful tweaks within its Group Policy Editor, including the ability to bypass Windows 8's lock screen for faster logging-on. It won't spare you from Metro, but it'll at least help you get to your safe and friendly desktop even faster.



Windows 8's Applications window is the sure-fire way to launch Metro apps without first having to jump into Metro.



This image represents the ideal Metro experience: an easy-to-understand (and ideally, touch-sensitive) Metro app on one screen, combined with the standard Windows 7-ish desktop as the primary input. In other words, Metro is better as a spice than as the main ingredient of Windows 8's dish.

on monitor two's Metro display minimizes your game and sends you back to the desktop on monitor uno.

Specific problem? Yes. But it's the kind of Metro annoyance that screams for a solution.

WINDOWS OTHER

While we think it's important to dig deep into the perils and pleasures of Microsoft's biggest change in the Windows 8 environment, that's not to say the company left the "Windows 7" portions of the operating system out to dry.

First, and most noticeable, is Windows 8's absurdly faster startup and shutdown times compared to any other iteration of the operating system. That's thanks to a lesser hibernation routine that (finally) stores the operating system's kernel session—Windows 8's system state and memory contents—to a file on your hard drive. Windows 8 employs multicore processing to read and decompress the contents of this "hiberfile" during boot, which leads to a much speedier system launch versus Windows 7, which requires a full system initialization each time you hit the power button.

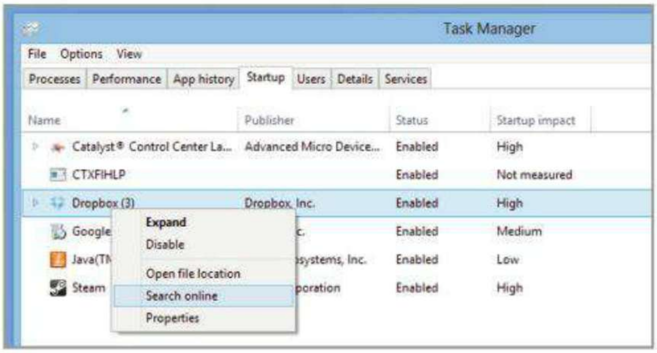
While you might notice slightly slower file transfers within Windows 8 versus Windows 7, were you to compare the two directly, it's because Windows 8 now builds malware scanning directly into the process (helped by the integration of Windows Defender, formerly Security Essentials, into the operating system). We don't mind that a bit, especially when it's accompanied by Windows 8's amazing new File Transfer feature. Not only can you now pause and cancel transfers whenever you want, but Windows 8 also gives you a throughput graph that populates your speeds in real time. It almost makes us want to forget about TeraCopy.

Windows 8's Task Manager receives a similar face-lift, including a wonderful "historical" option that shows you just how many resources various apps have consumed over the past week—Metro-only apps, however, which dovetails nicely with the interface's "never really closes your apps" treatment. And, heavens be praised, Windows finally integrates a "what the heck is this?" option for its Startup tab, which gives you a quick way to search for more information about various apps that run once Windows 8 boots.

The Office-like "ribbon" that now adorns the top of Window 8's File Explorer takes a little getting used to, but it's a great way to organize all of the most useful settings you need to access within a single window. Its available options even change dynamically depending on what you're clicking, from applications, to pictures, to movies, etc. It's still a shame that even File Explorer can't escape Microsoft's need to horizontal-ize Windows 8—you can view more files in a directory when file details are displayed at the bottom of the window, not on the right-hand side.

And, of course, it's hard to overlook Microsoft's head-nod to the cloud in all sorts of various permutations. There's the SkyDrive app, a mini-Dropbox of sorts for 7GB of your most important or interesting files that's wonderfully interwoven with other apps like Office 2013. There's Window 8's native synchronization with your Microsoft Live account (should you set up Windows 8 with one), which allows you to keep your Windows preferences, Metro app data, bookmarks, passwords—the list goes on—in sync no matter which computer you're using Windows 8 on.

Though you'll never need to use them, astute *Maximum PC* reader that you are, Windows 8 even tosses in some great features for restoring your system in the face of disaster (good luck finding the buried System Restore app, even if you use the Metro search tool). A "Refresh your PC" option copies your data, reinstalls Windows, and transfers your data back—the "lesser" restoration technique that just might do the trick in the face of slowness or serious error. Window 8's more hardcore tool, the "Remove everything" option, does just that: nukes your drive, reinstalls Windows 8, and begins the initial configuration process anew.

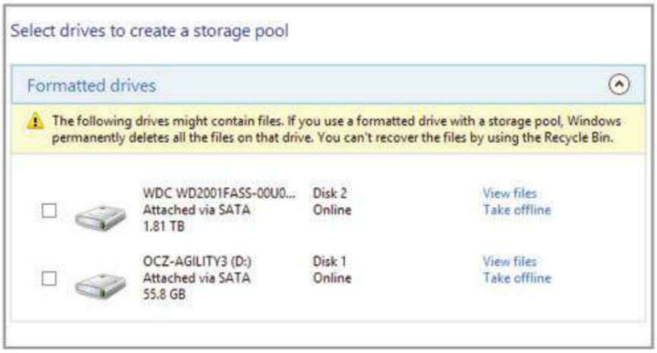


Name	Publisher	Status	Startup impact
Catalyst® Control Center La...	Advanced Micro Device...	Enabled	High
CTXFIHLP		Enabled	Not measured
Dropbox (3)	Dropbox, Inc.	Enabled	High
Google	c.	Enabled	Medium
Java(T	systems, Inc.	Enabled	Low
Steam	poration	Enabled	High

No longer will you have to manually type in strange application names to figure out just what the heck is loading when your system boots. With Windows 8, discovery is but a mouse-click away.

OUR FINAL THOUGHTS

Considering that a copy of Windows 7 Home Premium costs north of $80, we think it's completely fitting that a standard Windows 8 upgrade costs $40: Metro's worth can be counted on one hand for a typical desktop user, but the improvements found across the



Select drives to create a storage pool

Formatted drives

⚠ The following drives might contain files. If you use a formatted drive with a storage pool, Windows permanently deletes all the files on that drive. You can't recover the files by using the Recycle Bin.

☐	WDC WD2001FASS-00U0... Attached via SATA 1.81 TB	Disk 2 Online	View files Take offline
☐	OCZ-AGILITY3 (D:) Attached via SATA 55.8 GB	Disk 1 Online	View files Take offline

Windows 8's more advanced Storage Spaces tool allows you to add new storage sources at any time—hard drives, flash drives, or other external storage devices—to create giant storage "pools" with redundancy policies you decide on.

"Windows 7" version of the OS are certainly worth paying for. Even with Metro's annoyances—and we haven't even covered the full list in this extended review of the OS—Windows 8 is a good-to-have, but not supremely necessary upgrade. Those who made the jump straight from Windows XP to Windows 7 know the feeling we're describing here.

The features we've touched upon, and some of the operating system's more hardcore elements that we haven't—like Windows 8's Storage Spaces or File History feature—just about balance out the general issues you'll deal with when confronting Microsoft's "newbie mode" head on. It would be wrong to fear Windows 8 because of the sweeping changes (and poor follow-through) Microsoft has introduced into an otherwise fine desktop operating system. Upgrade your OS. Bask in your faster boot times. Synchronize your settings and files with Microsoft's fluffy clouds. Heck, burn and *mount* ISO files—that's a new one for Windows!

Fear Windows 9 instead. Once Microsoft cuts the cord on the classic desktop, kiss your productivity goodbye. Say hello to Microsoft marketplaces accompanying everything on the OS—much as they do now with a handful of Metro apps.

Us? We plan to prepare for the desktop apocalypse by stockpiling copies of Windows ME. $100 per. Cash only.

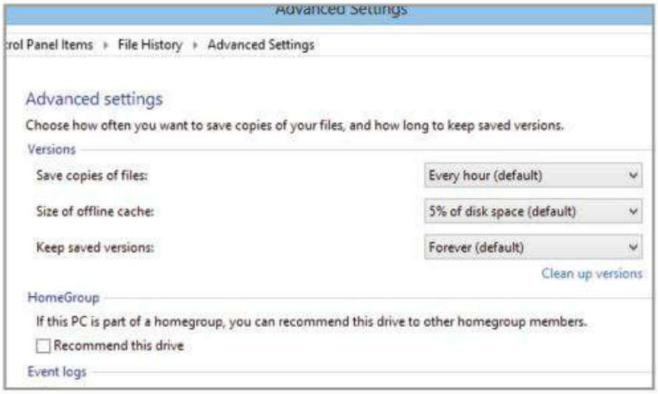
VERDICT 7

Windows 8

START MENU Vastly improved boot times; excellent cloud integration on all fronts; comprehensive desktop and system search; improved multi-monitor support; super-speedy installation.

METRO Metro is too simple; jarring effect of constant desktop/metro switching; lacks UI customizability where it's needed; Metro organization more difficult than standard Start Menu.

$120, www.microsoft.com



Advanced Settings

rol Panel Items ▸ File History ▸ Advanced Settings

Advanced settings

Choose how often you want to save copies of your files, and how long to keep saved versions.

Versions

Save copies of files: Every hour (default)

Size of offline cache: 5% of disk space (default)

Keep saved versions: Forever (default)

Clean up versions

HomeGroup

If this PC is part of a homegroup, you can recommend this drive to other homegroup members.

☐ Recommend this drive

Event logs

Windows 8's File History setting, buried deep within the Control Panel, is yet another "backup" technique that saves shadow copies of your data to other hard drives, external devices, or network-based storage.

WINDOWS 8: UNDER THE HOOD

While the new Metro UI will be what catches your attention in Microsoft's latest OS, there's actually far more under the hood that offers tangible performance benefits.

USB 3.0 Native Drivers

Windows 8 brings native USB 3.0 drivers to the mix, so no longer will you have to hunt for USB 3.0 drivers after your clean install. Even better, USB 3.0 performance is greatly increased with the native Microsoft drivers, too.

Windows Acceleration

Windows 8's implementation of Direct2D—the API for hardware-accelerating text, bitmaps, and other UI elements—offers a huge leap in performance over Windows 7 by relying on DirectX 11.1 to accelerate 2D graphics. Other improvements include 60 percent faster decompression of JPEGs and PNGs and techniques to make graphically intense chores drink less power.

DirectX11.1/WDM1.2

DX11.1 offers fairly innocuous changes from DX11, with the most noticeable being support for enhanced 2D graphics acceleration. DX11.1 also officially adds stereoscopic support, improved memory management, and better management of tile-based rendering for low-power applications.

Improved Scheduler

We already know that AMD says Windows 8 will give its Bulldozer cores an uptick in performance, thanks to an improved scheduler that can deal with AMD's core design, but it's apparently also a bit faster on Intel parts. See our performance analysis on page 32 for more info.

App Suspension

This applies more to the Metro side of the fence, but instead of Metro apps staying open and sucking up RAM, Windows 8 will suspend the applications to disk when not in use and also let the OS reclaim RAM easily. Even desktop apps, though, can be individually suspended or have components suspended when physical memory is running low.

WINDOWS 8 VS. WINDOWS 7: FIGHT!

Windows 8 haters have already labeled the new OS as the second coming of Windows Vista, but those who can contain their bile know that Win 8 is likely to be far from the performance-sucking, driver-breaking Windows Vista in its pre-SP1 days.

To find out how Windows 8 compares to the lithe Windows 7, we took an Asus P8Z77-V Premium board; inserted a Core i7-3770K, a GeForce GTX 690, 8GB of DDR3/1866, and an OCZ Vertex 4 SSD; loaded up Windows 7 Professional SP1; and ran our benchmarks. We then took an identical Vertex 4 SSD, loaded up Windows 8 Professional, and reran our benchmarks. We used the same beta 304.79 GeForce drivers for both and the latest beta drivers available from Asus for our testing.

The verdict? We expected the scores to be nearly identical, and for the most part they were. As Windows 8 is built on the foundation of Windows 7, we didn't expect a quantum shift here, but we did see some performance differences. The most glaring difference was in PCMark 7, where Windows 8 produced significantly faster scores in the creativity and computation tests.

Why such a huge difference? We suspect it's the result of changes to Windows Media Foundation in Win 8. Windows Media Foundation is Microsoft's replacement for DirectShow, which was implemented in Windows Vista. 3DMark 11 also showed a difference, but in Windows 7's favor, by a smaller percentage, in the physics and combined score. The difference there is likely due to some efficiency with the Bullet Physics engine that FutureMark uses in the test. More importantly, the graphics score is the same between operating systems, which tells us there should be no difference when gaming in Windows 7 or Windows 8—at least on Nvidia hardware.

Windows 8 includes native USB 3.0 support, and we saw it smoking the stock Windows 7 USB 3.0 performance by a hefty margin. Our Asus board, however, includes a Turbo mode, which puts it within striking range of Windows 8. USB 3.0 performance on Windows 8, for the most part, is pretty awesome, though.

The rest of our tests were mostly a wash except in two interesting instances: Cinebench 11.5 and X264 HD 5.0.1. Both are multithreaded like mad, and both show about a 5 percent advantage in Windows 8. This could quite possibly be a sign of the improved scheduler in Windows 8.

To sum up, Windows 8 performance is generally the same as Windows 7, with a performance edge in anything that uses the Windows Media Foundation and likely anything that is heavily multithreaded. USB 3.0 is also markedly improved. We do note the issue with Bullet Physics in 3DMark 11, but we don't think it's a very serious issue. So all you haters better find something else to hate on. **–Gordon Mah Ung**

SPECIFICATIONS

	Windows 8 Pro	Win7 SP1 64-bit
PCMark 7 Overall	**6,056**	5,712
PCMark 7 Lightweight	**6,146**	5,726
PCMark 7 Productivity	5,406	**5,619**
PCMark 7 Creativity	**9,925**	5,602
PCMark 7 Entertainment	**5,913**	5,891
PCMark 7 Computation	**12,605**	5,775
3DMark 11 Overall	P14,042	**P14,408**
3DMark 11 Graphics Score	17,333	17,305
3DMark 11 Physics Score	9,543	**10,095**
3DMark 11 Combined Score	8,182	**8,924**
Cinebench 11.5 CPU	**7.94**	7.75
Cinebench 11.5 OpenGL	59.11	59.21
X264 HD 5.0.1 Pass 1 (fps)	**77.9**	73.5
X264 HD 5.0.1 Pass 2 (fps)	15.3	15.3
Stitch 2.0 (sec)	866	858
ProShow Producer 5.0 (sec)	**1,461**	1,486
Unigine 3.0 (fps)	54.4	54.1
Valve Particle Test (fps)	210	208
Resident Evil 5 (fps)	**299.9**	294.2
SiSoft Sandra Bandwidth(GB/s)	24.66	24.46
Crystal Disk Mark SATA 6Gb/s R/W (MB/s)	522.5/232.7	507.4/266.6
Crystal Disk Mark R/W (MB/s)	419/184	257/183

We used an Asus P8Z77-V Premium board outfitted with a stock-clocked Core i7-3770K, 16GB Corsair DDR3/1833 RAM, GeForce GTX 690, and OCZ Vertex 4 SSD to test Windows 7 Professional SP1 64-bit and Windows 8 Professional 64-bit. For our SATA performance testing, we used an OWC Mercury Extreme Pro 6G on the Intel Z77 PCH. For our USB 3.0 testing, we used a Patriot Wildfire SSD in an Asus UASP-enabled USB 3.0 enclosure on the Intel Z77 PCH controller.

WINDOWS RT: WHAT IS IT?

Even though Microsoft is planning to put the full version of Windows 8 onto its upcoming Surface tablet, the company realized it would also need a stripped-down version to run on ARM tablets and cell phones, so it has created Windows RT to handle those duties. Windows RT, which stands for Windows Runtime (we know, the name is horrible) is designed to run one thing and one thing only—apps from the Microsoft store. That's all it will do, just like how an iPad or Android tablet only lets you add or remove applications. There will be no desktop, no file explorer, or any other trappings of a traditional Windows environment. Think of it this way: Imagine if Microsoft yanked Metro's tile-based interface out of Windows 8 and created an operating system out of it; that's Windows RT in a nutshell.

Now before you go getting your jimmies rustled, consider this: Using apps is all a tablet is designed to do. You'll have an app for your email, web browsing, e-books, and so forth, so you should be able to accomplish most of what you can do on today's tablets on a Windows RT device. You'll even be able to be mildly productive, as Microsoft is bundling a *free* version of its ubiquitous office suite, tentatively named Office RT. And though you'll surely be able to download some sort of media player, Windows Media Player will not be bundled with Windows RT. Hopefully, VLC will come to the rescue.

What can't you do in Windows RT? You won't be able to install whatever Windows software you have lying around, so put that USB key away for now. If it's not in the Windows 8 store, you can't install it. Good news, though—*Maximum PC* will have an app, so you can read all about the latest hardware anywhere you take your tablet (we won't ask where that is). **–Josh Norem**

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CASES

MEMORY

GAMING KEYBOARDS

GAMING MICE

HEADSETS

SOLID-STATE DRIVES

THE GREAT 2013 CASE

SEVEN CASES MEET ON THE STARTING LINE, BUT WHICH ENCLOSURES MAKE IT TO THE END OF OUR MEGA-ROUNDUP WITH A MEDAL AROUND THEIR FRONT PANELS?

By David Murphy

COOLER MASTER
Xclio

RACE

IF YOU THOUGHT that the only innovation in modern chassis design was the (long-awaited) switch from USB 2.0 ports to USB 3.0 ports at all price levels, you haven't seen anything yet. The cases in this roundup run the gamut of features: from inexpensive chassis that attempt to deliver a lot of functionality without fattening up the price, to simple-looking enclosures that hide a wealth of must-haves, to some of the most eye-opening cases we've seen—that don't quite stack up once you look beyond their crazy offerings.

In other words, it's your typical case roundup.

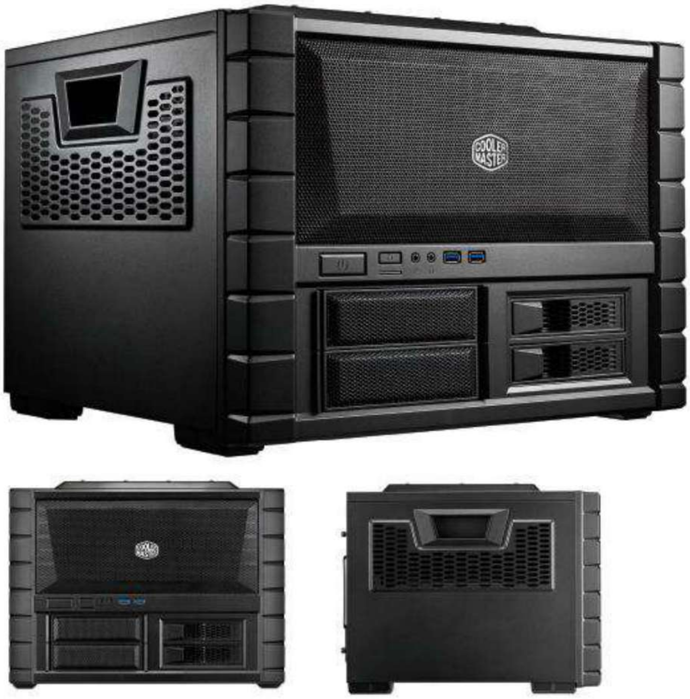
Just to lay out our criteria a bit, here are some of the elements we typically look for when we run the magnifying glass over a case: features that take time and effort out of the installation or upgrade process, like screwless drive bays. Minimal annoyances—like having to snap off a case's entire front panel just to remove its drive bay covers. Adequate cooling, ideally positioned so that one's hard drives, video cards, and general motherboard area all receive a steady stream of air. And, of course, strong cable management: Nobody likes to open up a case and find Medusa.

Beyond that, the great case race is anyone's to win. As for how each manufacturer balances "cool" with "functional," you'll have to read on for all the gory details!

Soprano
Tt
msi
CORSAIR

COOLER MASTER HAF XB

DON'T CALL THIS CASE 'STUMPY.' IT BITES



It's not very often you see a manufacturer going for the fabled, "cube design," but this is not your standard case by any stretch of the imagination.

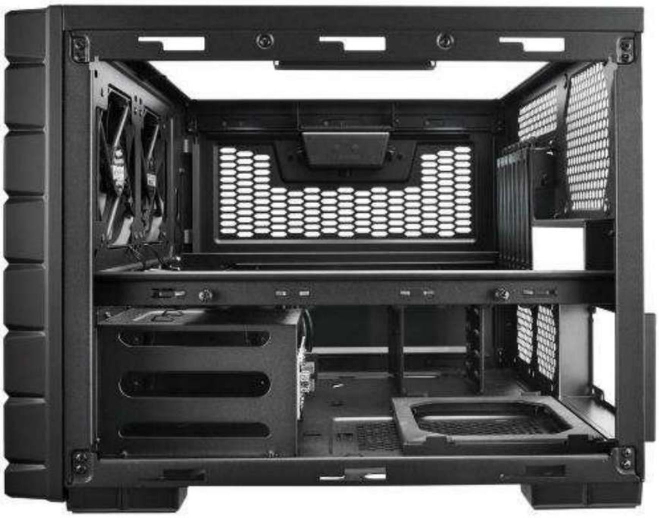
COOLER MASTER'S HAF XB case is a hybrid design that attempts to kill two PC birds with one stone: It's an open-air chassis for system builders who want to be able to swap out their components pit stop–style, and a standard, covered chassis for folks who like having four walls and a roof around their system's precious parts from time to time. For the most part, it works—but we would have loved to see a few tweaks to make the system even easier to use for the frequent parts-swapper.

The cube-like case leaves little room for error. Its 17.5x13x16.5-inch size is divided into a top and bottom half on the inside: Your ATX, microATX, or Mini-ITX motherboard rests up top—pray you don't have a huge cooler overtop your CPU, as you get just under 6.5 inches of vertical space (from the silicon on your motherboard) to play with, so forget about attaching a 20cm fan to the case's top. The bottom portion of the HAF XB is where you'll precariously thread your 7-inch-or-shorter power supply, connect up the case's two front hot-swap bays, stuff your optical drive in one of the case's two tool-free 5.25-inch bays, or slap some SSDs in the four additional 2.5-inch bays provided.

As for the hybrid bit we previously mentioned, Cooler Master has designed the open-air case to work just like that, with the system's sides and top bare to the world. However, when you want to transform the chassis into a normal, box-like enclosure, you just need to reattach the case's sides and top with the provided thumbscrews. While the process is certainly easy for those who have ever screwed-in a side panel before (that's most of you reading this), we wish that Cooler Master could have used the kind of thumbscrews that remain attached to the case (or panel) after you've loosened them. Losing those at a LAN party would be a real nightmare. That, or Cooler Master could have used quick-snap latches instead—an even stronger match for this Transformer of a chassis.

The case gives you a lot of expandability for its size—including room for seven PCIe devices in all, and video cards up to 13.1 inches in length—as well as two USB 3.0 ports on the front and two beefy, 1,800rpm, 12cm fans directly behind that for air intake. If you're crazy enough to try water-cooling in the tight confines of this chassis, it does support a single 24cm radiator on the front, if you first remove the fans, in addition to a single 12cm radiator on the case's rear. While indentations on the rear of the chassis indicate a place where tubing *could* have been threaded, Cooler Master oddly omits any rubberized holes for doing so.

The Cooler Master HAF XB isn't for beginners. You're going to get to pretend you're a surgeon when you try to thread wires around the inside of this snug enclosure, even given the HAF XB's system-builder focus. It's still a compelling case for tinkerers that comes with plenty of useful features, and one that's worth looking into for folks afraid of (or uninterested in) making the switch to a fully open-air design. Just don't try to water-cool it.



The beauty of Cooler Master's split-insides concept is that you only have the annoyance of stringing cables around the lower half once. Most of the parts you'll likely manipulate sit up top.

VERDICT 8

Cooler Master HAF XB

$99, www.coolermaster.com

COOLER MASTER SCOUT 2

EASY TO CARRY, TOUGH TO COOL

Looks can be deceiving. From the outside, this case is a winner. But from the inside, we're a bit skeptical.

THERE'S NO DOUBT in our minds that the design of Cooler Master's Storm Scout 2 chassis is going to draw eyeballs. On the outside, it's a beautiful case—punctuated ever-so-slightly by a red LED fan viewable through the case's windowed side panel, and ever-so-dramatically by the case's unique, rubber-coated steel handle up top.

The case's inside is less eye-catching. We love the three screwless 5.25-inch drive bays that merely require you to flick a switch from "open" to "lock" to secure your components in place. However, we're a little turned off by the flimsier rails that Cooler Master delivers to secure up to seven 3.5-inch hard drives in place; drive trays would have been better. Additionally, four of the drive bays have to go if you're using a video card that's larger than 28.7cm (approximately 11 inches)—and there's no easy way to just pull them out sans screwdriver.

Thumbscrews are your new friends for the case's seven PCIe expansion slots, and you'll have to install both standoffs and screws for your motherboard. That said, the Storm Scout 2 makes cable management easier with the five holes (three rubberized) Cooler Master cuts right into the motherboard tray—though they could have been a little bigger.

Our biggest problem with the Storm Scout 2 is its cooling—not due to its potential, as the case supports up to nine fans in total (a mix of 12- and 14cm fans, but mostly 12cm). Rather, the case ships with just one fan preinstalled: the aforementioned 12cm LED fan on the case's rear. You can toggle the light from on to off, as the flames shooting out from your hot components will be all the dramatic lighting you really need.

Two USB 3.0 and two USB 2.0 ports adorn the case's front, which you can hide with a little pull-down cover if you so desire. It's another one of the many tricks Cooler Master stuffs into the Storm Scout 2's hat; we just wish we could have some more fans, too.

VERDICT **6**

Cooler Master Scout 2

$99, www.coolermaster.com

MSI STEALTH

YOU'LL LOVE THE COLOR SCHEME, WE PROMISE

Just wait until you pop off the side of this chassis: a pretty world of black-and-blue awaits you.

WERE THERE an award for "Best Case Color Scheme," MSI's Stealth would win by a mile with its lovely black-and-light-blue–accented aesthetic. As for the case's design, however, MSI packs in a few problems to balance out the good bits.

We never thought we'd have to struggle so much with this case just to get a simple optical drive secured into one of its three free bays. That involves popping off the front panel just so you can remove the 5.25-inch bay covers—annoyance number one—and then somehow using the case's big, blue locking mechanisms of fail to roughly secure your drive in place. Spoiler: They're not very secure.

MSI does provide full trays for the four hard drives the case supports, which alleviated our frustration somewhat. It also packs two graphics card stabilizers right above that—a fun and quasi-useful addition that allows the case to support video cards up to 12.2 inches in length—but some extra 2.5-inch bays might have been more useful.

What the case lacks in big, fat cable-routing holes (you get four small, thin ones), it makes up for in the ludicrous amount of space between the rear of the motherboard tray and the case's right-side panel. You could hide a garden hose in this case, not just your power supply cables.

Two fans are included in the front: a 12cm fan, and a similar-size blue LED fan positioned directly next to the hard drive bays. On the top of the case's front are two USB 3.0 ports, two USB 2.0 ports, and a special USB port that dovetails with your MSI motherboard's "SuperCharger" functionality for speedy device charging. If you haven't drunk MSI's Flavor-Aid, however, it's just a standard USB 2.0 connection. Great looks, polarizing design: The MSI Stealth chassis leaves us feeling a little blue.

VERDICT **7**

MSI Stealth

$99, us.msi.com

THERMALTAKE NEW SOPRANO

A SOPRANO COULD SING INSIDE OF THIS CASE AND YOU'D NEVER HEAR IT

FINDING A CHASSIS that successfully combines practical noise dampening, useful features, and cooling can be a bit of a needle in the haystack sometimes—but in this case (pardon the pun), that's Thermaltake's New Soprano. The solid construction of this chassis creates an upgrading or installation experience that's free of frustration. Our only complaint with the case, if you can really call it that, is that it lacks pizazz.

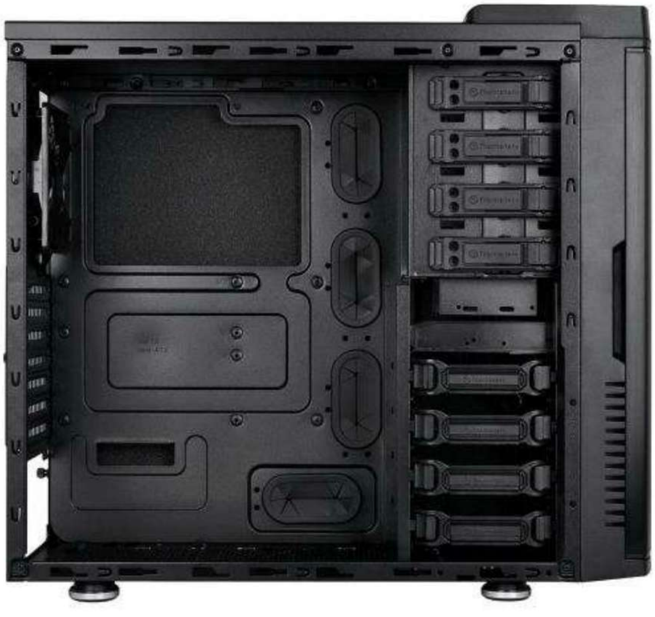
That said, give us function over pretty lights any day.

The jet-black exterior of the case uses a front-panel door to create a sleek, uncluttered aesthetic by allowing you to hide your components when you aren't specifically using them. The door doubles as an excellent noise-dampener and, we argue, a heavier-than-you-might-expect blunt object for use when squaring off against midnight intruders or zombie hordes.

Two USB 3.0 ports sit alongside two USB 2.0 ports on the top-front of the case; we're even more enthusiastic about the built-in hot-swap hard drive docking station for 2.5-inch or 3.5-inch drives that Thermaltake's constructed on the top of the chassis itself. It's a delightful and unexpected addition to the case that brings a lot of extra connectivity without harming the case's overall look or feel.

On the inside, Thermaltake uses four simple locking mechanisms to keep your 5.25-inch device held tightly. Installing an optical drive requires you to remove the drive bay's front panels—easily done without having to rip off any part of the case's front. Four screwless hard drive trays rest behind the case's secret weapon: a huge, blue-LED, 20cm fan that delivers plenty of air over your drives without blowing out your eardrums to do so. Above the primary 3.5-inch bays rests a single additional 3.5-inch drive bay and a single 2.5-inch bay for your solid-state needs (neither one screwless). Thermaltake positions the thumbscrews for the case's seven expansion slots on the exterior of the case. While that saves you a little room on the inside—giving the case space for a video card up to 12.2-inches in length—it also means that it's really hard to actually use your fingers to tighten or loosen the screws.

This case might look fairly simple on the outside, but it has just about everything you'd ever want or need. Trust us.



Thermaltake pulls out all the stops to make it as easy as possible for you to install or upgrade parts—minus the expansion slots, which will require a screwdriver.

Motherboard standoffs are built directly into the case—an excellent touch that saves would-be system builders a bit of time and hassle. A huge hole on the upper half of the motherboard tray exposes your CPU area for easier installation of aftermarket coolers, and that's joined by five other holes on the tray itself (four rubberized) for cable management. There's plenty of room between the rear of the tray and the case's right-side panel, even including the acoustical foam that Thermaltake's attached to the panel to give your ears a respite.

The only other fan in the case is a single, 12cm exhaust fan attached to its rear, and the only other fan you can install beyond that would be an optional 12cm intake fan on the case's bottom. That's the trade-off of having a "sound-proof" rig: more potential for heat. However, Thermaltake's done a masterful job of addressing this issue while building out a case that's packed with just about everything you'd want to have—assuming you care more about function than flash.

VERDICT
9
KICK ASS!

Thermaltake New Soprano VO900M1N2N

$120, www.thermaltakeusa.com

XCLIO TOUCH 787

MEET THE FUTURE, AND THE PAST, OF CASES

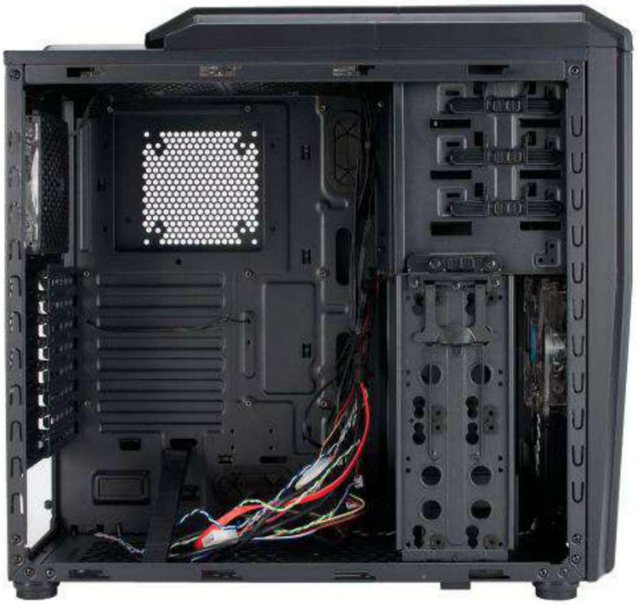
THIS KILLS US—it absolutely kills us. The Xclio Touch 787 has one of the most innovative, fun-to-use, Star-Trekian features we've ever seen on a case. And the substantial air-cooling it offers feels just a few miles per hour short of a category four. It's one of the few cases that we actually really *enjoy* interacting with on a daily basis.

But why, oh why, does Xclio have no idea how to build hard drive mounts?

Allow us to explain. The single most noteworthy and compelling feature of the Touch 787 is—as the name alludes—the giant touch-sensitive panel on front of the case's top. It looks as if it was ripped out of a standard *Star Trek: TNG* episode, and it functions about as well. After wiring up the panel with a standard Molex connection, you can tap its huge, circular buttons to turn the case's fans on and off; adjust their speeds to low, medium, or high; turn the fans' lights on and off; or lock and unlock the panel itself (to prevent accidental bumping).

Call it gimmicky if you want, but the responsiveness of the controls—and the pretty blue lighting when you've activated an option—is just downright cool. Unfortunately, Xclio seems to have spent most of its R&D effort on just that—the panel. Or perhaps the fans, as this system comes with no fewer than 10 12cm fans in total: one on the case's rear, two on the top, one in the front, and six (!) on the case's side panel. Cooling overkill? Yes. We appreciate the enthusiasm, but one large fan on the side panel (for example) could have pushed plenty of air at a lower RPM and noise level.

All the standard features on this case are the same as what you'd expect to find in this price range: cable-mounting holes, motherboard tray cutouts behind the CPU, locking mechanisms for the case's three free 5.25-inch bays, etc. We're not going to waste words going over these, simply because the design of the case's 3.5-inch bays—or lack thereof—presents a critical flaw in any user's enjoyment of this wind tunnel of a chassis.


It's too bad that Xclio didn't put some more thought into this case's internals. As is, they're not very good.

Words fail us. The touchscreen controls on this case must be seen to be believed.

To access the case's two actual hard drive bays, you have to unscrew and take apart a ridiculous bar of sorts that runs vertically from the case's bottom to just under its 5.25-inch bays. What's more, Xclio actually wants you to mount your drives to this bar, as well, just floating out there in mid-air. Presumably, Xclio wants to put nothing between the intake fan and your system's motherboard, but it's a bad design concept that's ugly for cable management, annoying to work with, and makes absolutely no sense whatsoever: It's the very definition of, "If it ain't broke...."

If it wasn't for Xclio's choices in designing its mounting "system" for hard drives, we'd consider this case—loud and over-the-top as it is—to actually be worth considering, if for nothing other than its uniqueness. The more we think about it, however, the more Xclio's design decisions hint at a company that doesn't actually know how to build a functional case, just a really cool-looking one.

VERDICT 5

Xclio Touch 787

$150, www.xclio.com

The Battle of the Budget Cases

Want a case on the cheap? Be sure you *don't* get what you're paying for...

Here we go—a descent into the budget barrel. It's understandable that you might be a little concerned about the quality of offerings you're going to see in the sub-$100 case market. You have every right to be: Just go to your local geeky retailer of choice and check out some of the horrible cases on the shelves that get offered at rock-bottom prices. We wouldn't want to put our worst enemy's motherboard into those.

Of course, you can find some real diamonds in the rough, but you're definitely going to have to do a little digging to uncover quality, inexpensive cases—especially given the sacrifices manufacturers typically have to make in order to hit these low price targets. We've dragged up two of these budget cases to show you just what we mean by the differences you'll find at this end of the spectrum: Take a look!

ANTEC ONE

One...singular sensation is not this chassis. The mid-tower Antec One feels a little flimsy in a few areas, which detracts from some of the better elements in this ultra-inexpensive case.

The Antec One comes with three 5.25-inch bays that use pre-attached locking mechanisms to keep your devices all snug and attached. However, this is the kind of case that requires you to pop off the entire front panel in order to remove the grilled covers over the empty bays—be careful with that, as we definitely broke off some of the tabs on these covers when trying to remove them ourselves.

Antec positions the entrance for the case's five 3.5-inch bays on the right of the case, if you're looking at it from the front, rather than the left. This decision boggled our minds at first, but the more we thought about it, the more sense it made: You would have to pop off both sides of the case anyway were you to install the drives from the left side of the chassis (using the provided rails) and this method allows Antec to build in some additional space for much-needed cable management. It's just a little weird at first.

The case's seven expansion-card brackets don't come with screws preinstalled into the case—a bit of an annoyance for those looking to ensure that the flimsy tabs stay on at all times. We do, however, like the recessed side pane that sits behind a huge hole cut out for the top half of one's motherboard: Cable-management and CPU cooler installations are a breeze.

Antec slaps two 12cm fans in the top-rear corner of the case; none over the hard drives. You get two USB 3.0 ports on the case's front; that's it. That's the Antec One: a price-conscious chassis that's good in a pinch, but could be a lot better.

VERDICT **6**

Antec One

$49, www.antec.com

The Antec is light enough that you could probably balance it on your fingers and spin it like a basketball. (YouTube that, if you try).

CORSAIR CARBIDE 200R

Delightful. Truly delightful. That's the best way to sum up Corsair's sub-$100 Carbide 200R mid-tower chassis. It's roomy, it's well-designed, and—most importantly—it doesn't invite any annoying features or ill-designed elements along for its inexpensive ride.

All of the Carbide 200R's drive bays are completely screwless, a wonderful touch for those looking to make modifications to their system without busting out the toolkit. Popping off the flat, solid panels covering the case's three 5.25-inch bays is easy and destruction-free—almost as easy as it is to slide and lock up to four 3.5-inch hard drives into the case's left-facing bays. You can use screws to attach up to four 2.5-inch drives into a provided internal enclosure if you really don't want your solid-state drives to jiggle.

Motherboard standoffs are built directly into the Carbide 200R: Just slap down your board, grab a few screws, and you're set. Five different cable-routing holes cut directly into the tray make it easy for you to hide your ugly wires, and a large area cut out behind the top of the motherboard tray speeds along the (often agonizing) process of aftermarket CPU cooler installation.

The case comes with one 12cm fan in the rear and one in the front. While we would have preferred that the front fan was placed to push some air over your hard drives, at least it's able to direct much-need cooling on your video card (up to 11.8-inches long). You can also stick up to five additional 12- or 14cm fans around the case's top, side, and bottom, as well as one more 12cm fan in the front (covering your hard drives).

The case comes with two USB 3.0 ports on the front—more importantly, popping off the front panel to do any modifications to the Carbide 200R doesn't result in a tangle of wires coming with it. It's these little touches, and more, that make this case such an inexpensive delight.

VERDICT **9**

Corsair Carbide 200R

$60, www.corsair.com

The Carbide 200R doesn't win huge points for its looks, but there's a lot going on inside this chassis for its low price.

Edge™ Z40

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By Jonathan Roberts

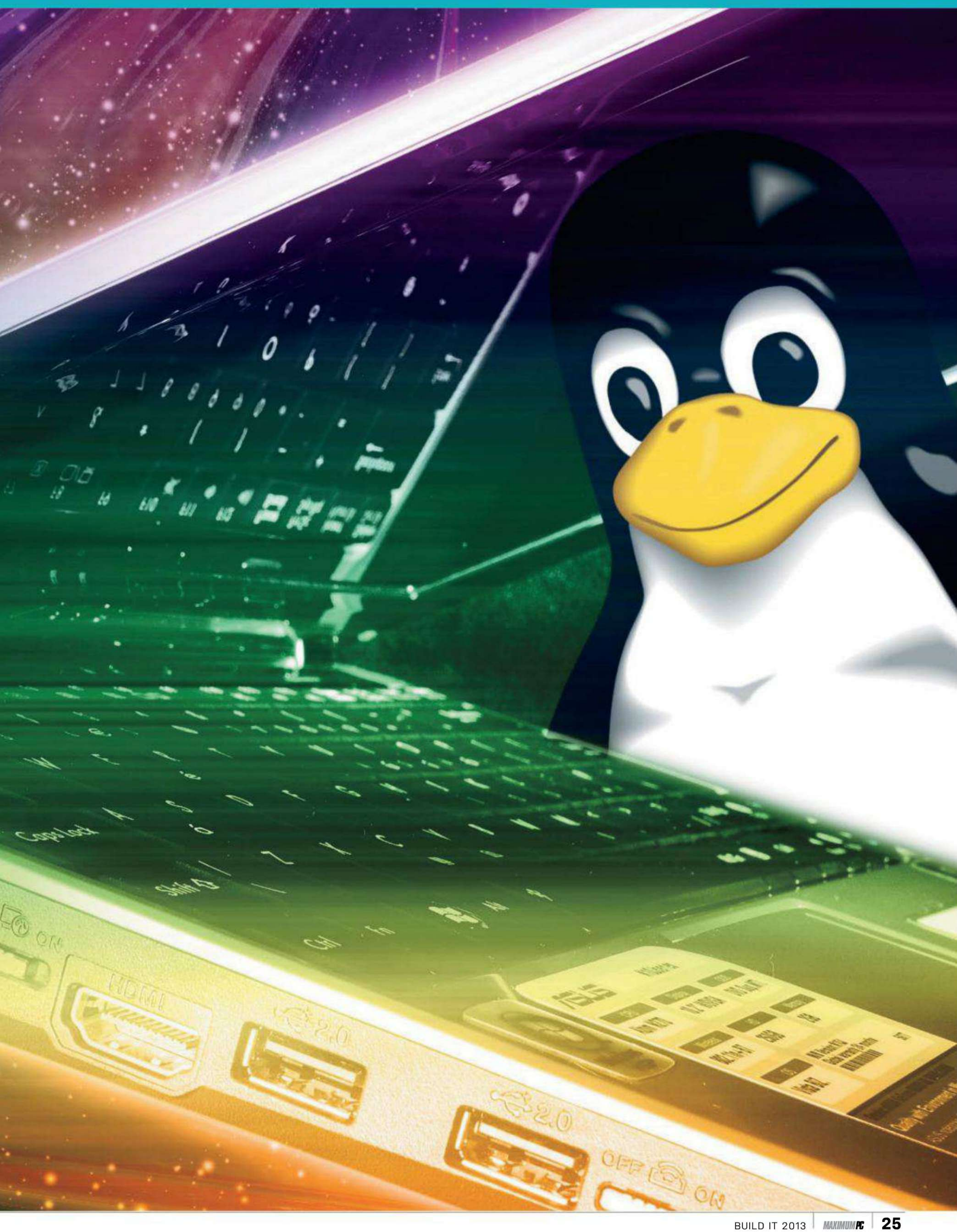
DISCOVER LINUX

THERE'S NEVER BEEN A BETTER TIME TO TRY THE ALTERNATIVE OS

WINDOWS 8 might offer some nifty new features and performance to PC users, but it also comes saddled with the touch-centric UI commonly known as Metro, which Microsoft has made impossible to circumvent. The upshot is that Windows 8 will require us to relearn how we do things on the desktop. Perhaps—just perhaps—that time could be better spent finally learning to use Linux.

Besides offering a number of distinct and useful attributes over Windows and Apple's OS, Linux is far more conducive to tweaking and customization. You could even say that Linux is the operating-system analog of hardware tinkering. Why would a power user settle for anything less?

If you're feeling the least bit intrigued, you need to check out this guide. We'll begin by looking at what Linux is and why you'd want to use it. Then we'll show you how to get your feet wet in a risk-free way, before explaining how to install Linux and go about your day-to-day business with it.


Caps Lock
Shift
Ctrl
Fn
Alt
HDMI
2.0
2.0
ON
OFF
ON

WHAT IS LINUX?

Linux is an operating system in the same way that Windows, Mac OS X, iOS, and Android are all operating systems. Each provides a platform on which everything else on your computer runs.

This platform is made up of lots of different parts. Some parts are responsible for making the hardware work, others for displaying the user interface, and still other parts for ensuring that applications can work with the hardware and with each other.

Just like Windows et al., Linux performs all of these functions. You may be asking, "If Linux does all the same things that Windows or Mac OS X does, why bother switching?" The answer is that Linux has its own way of doing things, and for some people, this way is better.

Linux is a powerful and attractive desktop operating system with unique features you won't find on any other platform, including these spectacular spinning virtual desktops.

SECURE, FLEXIBLE, POWERFUL

There are several technical aspects to Linux that make it distinct from other operating systems. The OS has a radically reduced risk of catching viruses—so much so that only very specialized users need to run antivirus software.

It's modular, and so infinitely flexible. For example, while Windows limits you to a single user interface (what the system looks like), on Linux you can choose from a dozen different options. It runs well on very old and slow hardware, as well as on modern laptops and supercomputers (by some counts, 90 percent of the world's supercomputers are currently running a variant of Linux).

It's designed with security in mind, with features such as strong encryption included as standard.

One caveat you'll want to keep in mind with regard to Linux's technical differences is that it has a completely different approach to making hardware work. This means that Linux's developers have to add support for hardware all by themselves. They do a remarkably good job of this, and you'll find that almost every piece of hardware imaginable works "out of the box." There are exceptions to this, though, particularly when hardware manufacturers keep the way their devices work a secret. On these occasions, the developers have to figure out just how a device works for themselves, and then write the software to make it work—it's kind of like listening to a piece of music to figure out the score.

This most often applies to graphics cards and wireless cards, although even these are almost universally supported these days. Later in the article, we'll show you how to check if your hardware works, and how to get help if it doesn't.

FREEDOM

Another way Linux differs from other OSes could broadly be called "ideological." Linux is what's known as free, or open-source, software. This doesn't necessarily mean it's free of charge (although it often is), but that anybody can study how it works, share it with their friends, modify it, and use it for any purpose they wish.

This sounds a bit out there, but it's actually a very important aspect of Linux. For starters, it means that it's not developed by a single company or nation, but instead by a massive community that's spread around the world.

This means you don't need to worry about a company going bust and taking your photos, documents, and other data with it; neither do you need to worry that your computing activity is surreptitiously being recorded, or otherwise influenced, to advance some unknown group's interests. With free software, your computer works for you.

Of course, some people don't use Linux for any of the aforementioned reasons—they just like the way it works. What's more, as you'll soon see, you can try Linux in a virtually risk-free way, without modifying the current contents of your computer. So, really, what's stopping you from giving it a try?

FIRST THINGS FIRST

Before you take Linux for a test drive, you must first back up your data. This isn't because using Linux is dangerous—in fact, as we've said, it's virtually risk-free—it's just that accidents do happen,

DISTRIBUTIONS: WHAT YOU NEED TO KNOW

As Linux is modular (the user interface, hardware interaction, etc., are all separate from each other), and there are so many ways to combine the different elements, you'll never use just "Linux." What you'll be using is a distribution of Linux. Each distribution brings together different combinations of the available components, and each configures them with a different audience in mind.

For the purposes of this article, we'll be focusing on a general-purpose distribution called Ubuntu. It's widely regarded as the easiest distribution to get started with, and it has a large number of users who are willing to help when you get stuck.

After reading this article and getting comfortable with Ubuntu, don't feel confined to this distro. Many users think that trying lots of different distributions is fun and a good learning experience, so they encourage new users to experiment as much as possible.

and you should back up your data regularly anyway. If you don't yet have a backup solution, Jungle Disk (www.jungledisk.com) is a great option. It works with Windows, Mac OS X, and Linux, and it has a basic monthly cost of just $2 (plus a per-gigabyte storage fee). More importantly, you can use either Rackspace or Amazon's cloud storage to back up your files. This means your files are kept in a different location from your computer, ensuring they'll remain safe in the event of a physical disaster at your location.

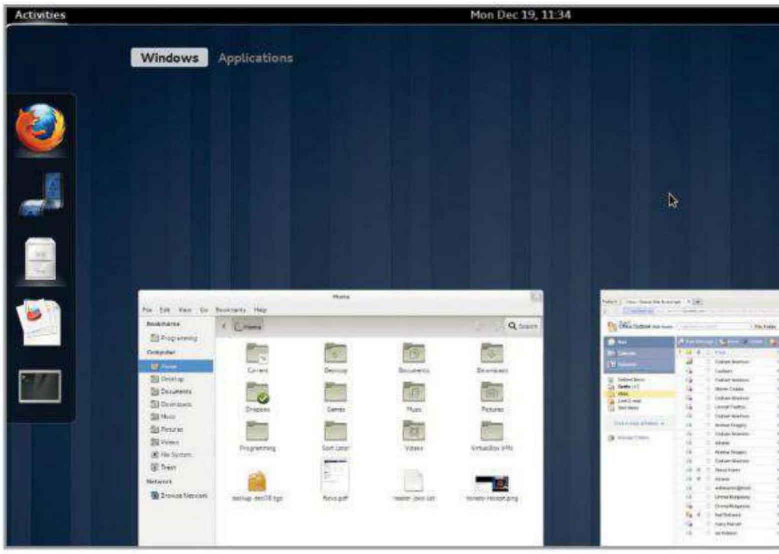
Of course, if you're in a hurry or you have limited bandwidth, you could burn your data to a DVD or put it on a portable hard drive—just remember to keep it in a different location.

TRYING LINUX

With your data safe, we're ready to get started and load Linux for the first time. We recommend a version of Linux known as Ubuntu (See "Distributions," left). This version of Linux, like many, is really clever, because you can use it as a live CD. Just download the operating system as an ISO file, then burn to disc—you can find full instructions at www.ubuntu.com.

"Live CD" means you can run the entire operating system from the disc without it making any changes to your computer. If you decide you like Linux, you can then install it using the same disc; if you don't, you can just reboot your computer, take out the disc, and everything will be just as you left it. It's the perfect way to try Linux without risk. The only thing you need to bear in mind about live discs is that they're going to run slower than if the operating system were installed on your hard drive. So, while it's a useful way to get a feel for what a system is like, don't think that Linux is always so slow!

To use the live disc, you'll need to put the disc in your computer and then reboot. When the first screen appears, usually with your computer manufacturer's logo on it, you'll need to press a key to tell your computer to start from the disc, rather than your hard drive. This key is different on every computer, but it's usually F2, F12, or Del. The only way to be sure is to try the different buttons, one of which will display a boot menu. From this menu, you'll want to select the entry that corresponds to your DVD drive.



The Activities overview lets you manage running applications and launch new ones.

Follow through the various screens; eventually your computer should load Linux and leave you at the desktop—the main interface. Great! This is so cool! Now what? Well, the first thing to do is get familiar with the interface.

Remember, Linux isn't Windows, and it isn't Mac OS X. As with the technical and ideological differences, Linux's interfaces are different from others'. This means it will take some getting used to, but if you persevere, you'll be surprised at how quickly the new interface becomes second nature.

It helps that some of the most basic functions, such as the mouse, work just the same in Linux as in other operating systems. So, you use the left mouse button to select things, some of which require a double-click, and the right mouse button often pulls up a menu with further actions you can perform. That said, let's take a look around the desktop.

As you hopefully noticed while exploring the Activities overview, Linux comes with a great set of applications installed by default. This means you can get started working with your new operating system as soon as you've turned it on.

MULTIMEDIA SUPPORT: DOING IT YOURSELF

If you're like us, one of the main reasons you use a computer is to enjoy multimedia content. That's everything from videos of Benton the dog chasing deer through a park on YouTube, to sitting back and relaxing with a pair of headphones on while listening to Handel's *Messiah*.

As a result, you've probably built a collection of multimedia files and stored them in your existing operating system. Now you want to be able to enjoy them on your new Linux machine, too.

This is perfectly possible, but there's one small caveat you need to be aware of. Most people keep their music in MP3 format and their videos in MP4, and most like watching YouTube, which for now uses Flash to play its content. Because these are patented technologies and need to be licensed for distribution (even though they're free for personal use), most Linux distributions don't include them by default because they can't afford to. That doesn't mean you can't enjoy media in these and other patented formats, it just means that you need to add support for them yourself. In Ubuntu, this is a simple matter of installing a single package, called "restricted-extras." You'll want to wait until after you've installed Ubuntu on your hard disk, rather than doing this while running from the live CD.

A few of the applications will be familiar to users of other platforms, since they're available for all operating systems; some of the applications are Linux-specific, however, and aren't so well known (although they're generally just as good, if not better!).

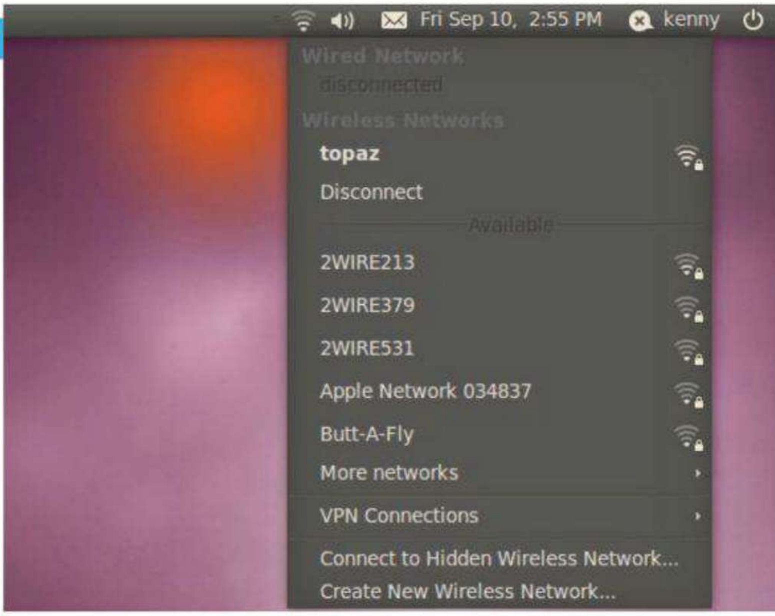
GETTING TO KNOW YOU

To speed you on your way to familiarity, we've compiled the below table, which compares Ubuntu's default applications with their counterparts on other operating systems. Most of the default applications are fairly self-explanatory, requiring little more than a bit of time playing with them to discover their essential functions. For those times when you're not quite sure how to do what you want, however, check out the online tutorials we've linked to.

The most important thing to do at this point is play around with everything. It's almost impossible to break anything, and if you do, you can just reboot your computer and remove the disc! Don't forget to launch the System Settings dialog from the user menu, too, as you'll find all kinds of options in there, including changing the wallpaper, the keyboard layout, and much more. While you're trying things out without fear of breaking them, now is a great time to test your hardware, too. If you've managed to boot Ubuntu successfully and explore the desktop, you can rest assured that all the most important bits work well already—including your graphics card.

TEST CARDS

Having said all of the above, one bit of hardware Linux occasionally has trouble with is wireless cards, so it's worth using this playing-around time to make sure that this works too. The easiest thing to do is to just make sure your computer can see some nearby wireless networks: To do this, click the small computer icon on the right of the screen and, if all is well, you should see a "Wireless" entry followed by all the nearby networks.



Wireless cards can sometimes be tricky in Linux. But if you see entries under Wireless Networks, you know you're good to go.

If you can't see this and you think you should, don't worry too much. With Linux, there's almost always a way to make things work, it sometimes just takes persistence and a helping hand to get there.

See "Getting Help with Linux" on the next page to find out how to go about solving your problem.

APPLICATION ALTERNATIVES

Ubuntu App	What It Does	Windows Equivalent	Online Tutorials
Firefox	Web browser	Firefox, Internet Explorer, Google Chrome	http://support.mozilla.com/en-US/kb/getting-started-firefox
LibreOffice	Complete office suite, including word processor, spreadsheet, and presentation programs	Microsoft Office, LibreOffice, OpenOffice.org	www.libreoffice.org/get-help/documentation
Banshee	Plays music, videos, and DVDs. Provides access to Amazon's MP3 store, as well as the Internet Archive. Also makes managing your iDevice and Android phone's media a cinch	iTunes, DoubleTwist, Windows Media Player	http://library.gnome.org/users/banshee/1.8/
Thunderbird	Reads, sends, and encrypts emails	Thunderbird, Microsoft Outlook	N/A
Shotwell	Organizes and displays photos	Picasa	http://yorba.org/shotwell/
Ubuntu One	Automatically stores files inside a special folder in the cloud	Ubuntu One, Dropbox	help
PiTiVi	Edits videos and exports them to different formats	Windows Movie Maker	https://one.ubuntu.com/help/tutorial/
Movie Player	Plays videos, with support for playlists; no support for media libraries, etc.	Windows Media Player, VLC	www.pitivi.org/manual/
Empathy	Instant messenger; works with many networks, including AOL, MSN, and Facebook	Trillian, Pidgin	N/A
Brasero	Burns discs, with support for audio as well as data discs	Nero Burning ROM	N/A

INSTALLING LINUX

Things are looking pretty good at this point. You've successfully started your computer with Linux instead of your normal OS; you've explored the interface and tried a few of the default applications; you've even checked that it works with your most important hardware.

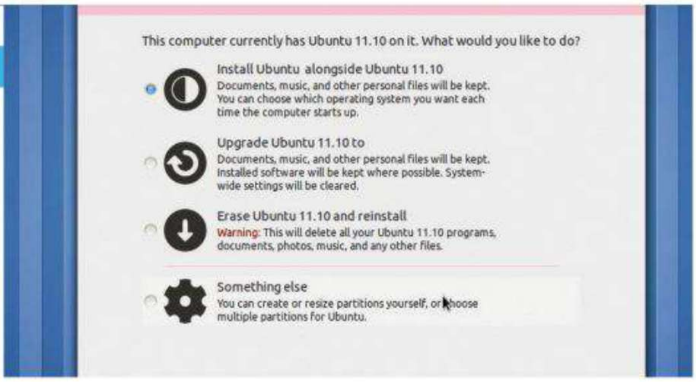
If, by this point, you're wanting to explore this new world further, then it's time to install the OS on your PC and learn more about the system. This will give you the chance to begin finding out how you can tweak the system, how fast it runs in the real world, and to use it with your own files in your day-to-day work.

This is the part where that backup you made is more important, as we're going to make changes to your computer's hard drive. It's easy, but in the event of any mistakes, you'll want to know that your data is safe. If you didn't make a backup earlier, do it now. To start the installation process, get to the desktop of the live CD as before, and then double-click the Install icon on the desktop.

From this point on, most of the installation screens will ask you straightforward questions about your language, time zone, keyboard layout, and the like. However, there are one or two screens that will require a bit of further explanation.

The third screen will give you some options covering how Ubuntu should be installed—whether to install it alongside your existing OS, replace the existing system entirely, or let you do your own thing.

What this screen is really asking is how to partition your hard drive. By shrinking the partition your existing operating system is on and creating a new one, Ubuntu's installer can let you keep the existing system while still making Ubuntu available to you. This is what the Install Alongside option will do, and this is the safest option to choose while you're just getting started. If you select this, every time your computer starts, a menu will appear asking whether you want to start Ubuntu or your previous system—aka dual booting. This way, if you still need your old operating system, whether for games or to occasionally use something familiar, you can just reboot and select its menu entry.



This computer currently has Ubuntu 11.10 on it. What would you like to do?

● **Install Ubuntu alongside Ubuntu 11.10**
Documents, music, and other personal files will be kept. You can choose which operating system you want each time the computer starts up.

○ **Upgrade Ubuntu 11.10 to**
Documents, music, and other personal files will be kept. Installed software will be kept where possible. System-wide settings will be cleared.

○ **Erase Ubuntu 11.10 and reinstall**
Warning: This will delete all your Ubuntu 11.10 programs, documents, photos, music, and any other files.

○ **Something else**
You can create or resize partitions yourself, or choose multiple partitions for Ubuntu.

Ubuntu's installer partitions your drive automatically, so you can use Ubuntu and Windows.

SECURITY

The other screen you'll want to pay extra attention to is toward the end, where you're asked for a username, computer name, and password. While it doesn't really matter what you choose to call your computer or user, you should think carefully about choosing a good passphrase, as this will greatly increase your security.

As we've often said, the best thing to do is string together a few random words, such as "MPClovesunicorns," to create something memorable and difficult to crack. Try to use some upper- and some lowercase letters, and maybe add a few punctuation marks, too.

This screen also gives you the option to encrypt your home directory (more on the home directory shortly), which provides extra protection if you ever leave your laptop on a train—or in any other position where some nefarious foe might get physical access to your computer.

GETTING HELP WITH LINUX: GENIUSES WITHOUT THE BAR

When you have a question about Linux, or something goes wrong and you need help, where do you turn? In most situations, there's no helpline to call, neither is there a Genius Bar to visit. Instead, Linux users take advantage of the friendly and supportive community of fellow users and developers who, on the whole, give their time for free. The question is, where do you find this community? Well, depending on your urgency and personal preferences, there are two main sources of help.

FORUMS

If it's not urgent and you can wait a few hours, or days, we recommend Ubuntu's official forums (http://ubuntuforums.org), where you can post a message in the appropriate subtopic. Other users will be able to see your message and respond accordingly. You'll get an email whenever anyone replies to a thread you've contributed to, so you'll know an answer's waiting.

IRC

If the problem's more immediate, or complex, you may want more interactive help. For this, most Linux users rely on Internet Relay Chat (IRC), which is a system for accessing live chat rooms. The easiest way to enter these chat rooms is to go to http://webchat.freenode.net. You can then enter a nickname and room to join, and you'll be able to chat through your web browser. Ubuntu has its own support and discussion room (or channel) called #ubuntu, so if you enter that in the channel box, you'll be able to chat with people who know lots about Ubuntu and are willing to help.

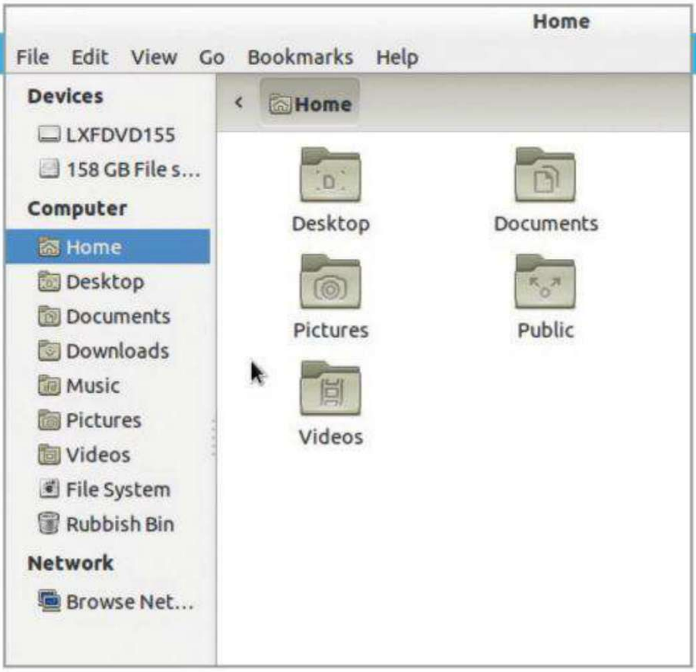
GOOD KARMA

One thing to bear in mind when using these resources is that it's important to be a good citizen yourself. By following these simple rules, your experience in the forums and chat rooms will be far more positive: Always be polite. Do some research before you ask a question. Often, you'll find your answer by searching for your problem in the forum or on Google. If your question has already been answered lots of times, people won't want to repeat themselves.

Give as many relevant details as possible when describing the problem.

Be open and honest about your knowledge of Linux, and you'll get help that's more appropriate for your level of expertise. As time goes by and you become more knowledgeable, you may want to take the time to give something back to the community by helping new users yourself.

MOVING TO LINUX?



On Linux, all your files are kept in the Home folder. This means there's only ever one place for you to go looking for your files, and only you can see them.

After installing Ubuntu, rebooting your computer, and selecting your brand-new operating system from the boot menu, the first thing you'll want to do is make all your existing data accessible.

This is a straightforward task. Launch the Activities overview, and from there select the filing-cabinet icon at the bottom of the dash. This will launch Nautilus, the default Ubuntu file manager. On the left of this window is a panel, and above all the bookmarked locations, such as Home, Pictures, and Downloads, there should be an entry for an "xxx GB File system."

This is the partition your previous operating system lives on, and which contains all your old files and folders. Accessing them is just a matter of double-clicking the entry, and everything will appear in the main part of the window. Most user documents and settings on Windows 7 and Vista are stored in the Users\[username] directory, on XP in Documents and Settings\[username], and on Mac OS X they're in the /Users/ [username] directory.

If you can't find this directory, check to see if there's more than one partition listed in the side panel. Some manufacturers ship their computers with a separate data partition by default, so you may need to look in these other partitions for your files.

COPYING AND LINKING

Once you've got access to the files, you may want to copy them across to the appropriate directory on your Ubuntu partition. This works the same as in all other operating systems: Use the mouse to drag a box around all the files you want to copy, go to the Edit menu at the top of the window, and select Copy (or press Ctrl + C). Then, go to the location on your Ubuntu partition where you want to store the files (probably in your Home folder, but maybe in the Documents, Music, or Pictures subdirectories) and select Paste from the Edit menu.

Of course, this will work best if you're not constantly switching between operating systems. If you are, then you may find that you end up with files that are out of sync with one another. The best way to avoid this situation is to work on the files straight from the Windows partition; if you do this, however, keep in mind that you'll have to open the file manager and click the partition each time you want to use it. There is a way to automate this, but it's beyond the scope of this feature. (Take a look at "Getting Help with Linux" on the previous page if you want to learn more about the process).

IMPORTING DATA

The final thing you'll want to do to make your new operating system feel like home is to import some of your files to the appropriate applications. For instance, now that your music files are accessible, you can import them into Banshee's database, which will then automatically download cover artwork and keep everything organized for you.

To import your music into Banshee, launch the Activities overview and begin typing Banshee. After a few characters, the Banshee icon should appear and be highlighted, at which point pressing Return will launch the program. Then, go to Media > Import Media, and select Choose Folders... in the window that appears. This will launch a file browser, from which you can browse to your Windows partition, or the location on your Ubuntu partition where your music files are stored. Select the folder that your music is stored in, and then click Import at the bottom of the file browser. Banshee will then take care of everything else for you. (Note that importing your photos to Shotwell involves a similar process).

It's also worth knowing that Banshee comes with support for several online media stores turned on by default, so you can download new music from Amazon, get podcasts from Miro, or pick out classic videos and audio from the Internet Archive. All of these are available at the bottom of Banshee's side panel.

THE HOME FOLDER: WHERE THE HEART IS

The Linux filesystem is notoriously cryptic, with folder names such as etc, var, usr, bin, and tmp. Fortunately, there's no reason why you ever need to deal with any of these, at least in day-to-day use. This is because, along with these cryptic folders, there's one called Home, which stores a subfolder for each user on the system.

The idea of these folders is that they store all the files and settings that belong to an individual user. So, when you're working on a document, you save it in your Home folder; when you transfer pictures from your camera, they'll go in your Home folder; and when you extract audio from a CD, that also goes in your Home folder.

Note that each user's Home folder is private to that user—with the exception of the root user, no one else can read its contents (see "Users and Privileges" on the next page).

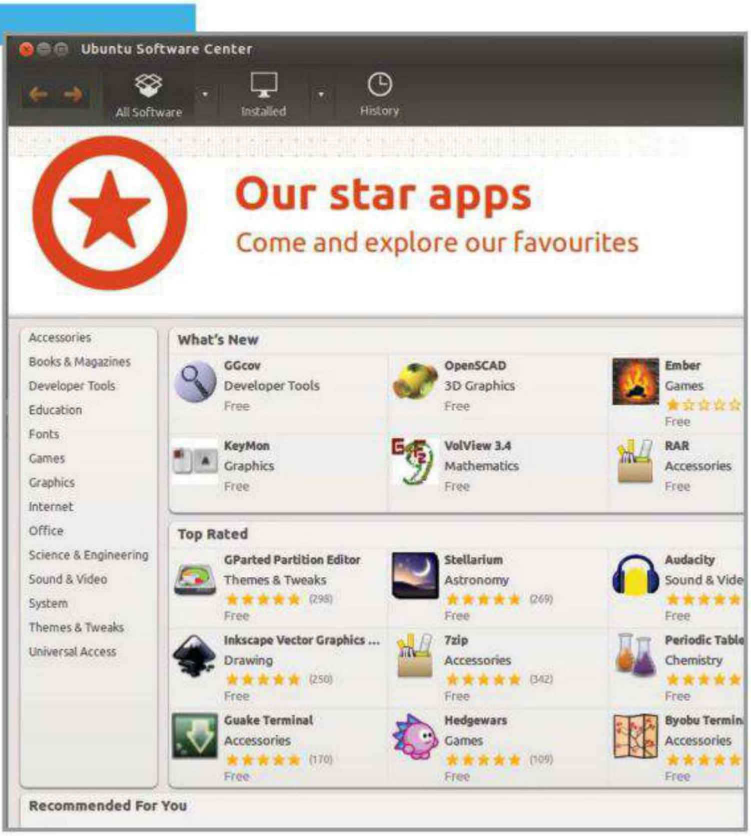
If you decide that you want to learn more about Linux, then you'll no doubt begin to tinker with the other files and folders, but as a normal user, there's no need. So don't worry about the et ceteras.

PACKAGE MANAGERS

The penultimate step on our journey is to show you how to install new programs and keep old ones up to date. This is an area where Linux has been ahead of the game for years. Rather than expecting you to go to third-party websites and download executable files (.exe in Windows, .dmg in Mac OS X), Linux distributions provide package repositories, which store all the software you can install on that distribution.

This is much more secure, since the packages in the repositories are all digitally signed to guarantee their origin. This means you can be sure who's providing the package, and that it hasn't been altered by someone with malicious intent (whereas on Windows and Mac OS X, there's little to guarantee the authenticity of the programs you install).

It also has the major advantage that all the software on your computer can be kept up to date automatically. So every time there's a security fix, you'll immediately be notified about it and given the opportunity to install it. It's really a very good system.


Ubuntu Software Center
All Software
Installed
History
Our star apps
Come and explore our favourites
Accessories
Books & Magazines
Developer Tools
Education
Fonts
Games
Graphics
Internet
Office
Science & Engineering
Sound & Video
System
Themes & Tweaks
Universal Access
What's New
GGcov
Developer Tools
Free
OpenSCAD
3D Graphics
Free
Ember
Games
Free
KeyMon
Graphics
Free
VolView 3.4
Mathematics
Free
RAR
Accessories
Free
Top Rated
GParted Partition Editor
Themes & Tweaks
(298)
Free
Stellarium
Astronomy
(269)
Free
Audacity
Sound & Vide
Free
Inkscape Vector Graphics ...
Drawing
(250)
Free
7zip
Accessories
(342)
Free
Periodic Table
Chemistry
Free
Guake Terminal
Accessories
(170)
Free
Hedgewars
Games
(109)
Free
Byobu Termin
Accessories
Free
Recommended For You

The Software Center lets you install new applications. It comes complete with a review and ranking system, so you can be sure you've picked the best application for the job.

INSTALLING AND UPDATING

On Ubuntu, the repositories are accessed through the Software Center. If you launch it from the Overview mode, you'll find yourself at the Software Center's homescreen. It's very much like the iTunes app store—here, you can see featured applications, browse by category, or search for applications.

Once you see one that interests you, click its entry and you'll be taken to a more detailed description of the program. This page includes user reviews, version details, and an install button.

Installed applications are marked by a green circle with a tick, and instead of having an Install button, these have a Remove button.

Updating applications uses an alternative program. From the Overview mode, you'll want to launch the Update Manager. You can click Check to look for new updates, and then Install Update to install them. It's rare that you'll need to restart your computer for updates to take effect, but you'll be notified if necessary.

THE COMMAND LINE

We're now at the end of our introduction to Linux. Before departing, however, we want to mention the command line. The command line is another interface for your computer. Rather than relying on using a mouse to click graphical elements, it interprets words and letters that you type into it. It's because of the command line that Linux has a reputation for being difficult, since, despite its power, it's not very intuitive. As you've seen in this article, however, you can use Linux to do lots of different things without ever having to touch the command line. That said, as you start to begin tweaking settings, writing code, or just becoming more of a power user, the command line is sometimes the best tool for the job. It can also be a lot of fun to learn.

USERS AND PRIVILEGES:
DO YOU HAVE PERMISSIONS?

Linux is designed with multiple users in mind. At the heart of this is the idea that every file on the system is owned by a particular user. This has lots of benefits. For starters, it means that an entire family can share a single computer, but all keep their files private. It also means that the system is more secure than it would otherwise be. If one user accidentally downloads a virus or enters a mistaken command, it can affect only that user's files—everyone else's, and the system as a whole, remain safe. When a user has the ability to read or modify a particular file, we say they have "permission" to do this. Every file can have its permissions set individually, and you can specify whether a single user, a particular group of users, or every user on the system can read or edit it.

There's one user on the system, however, who has permission to read and modify every file. This user is known as root, or the super-user, and should be used with caution. When you installed Ubuntu, you created a single user account for yourself. This account is not the root, but it still has permission to do certain tasks that usually require you to be the root, such as installing and updating applications. Exactly how this works isn't important now, but it *is* important that you know something about the root user and the idea of permissions. At the very least, it will explain why you can't read the contents of other users' home directories—by default, they own their files, and they're the only ones (besides the root) with permission to edit them.

PICK A DISTRO, ANY DISTRO

An astounding array of Linux variants means you can choose a distribution that meets your specific needs

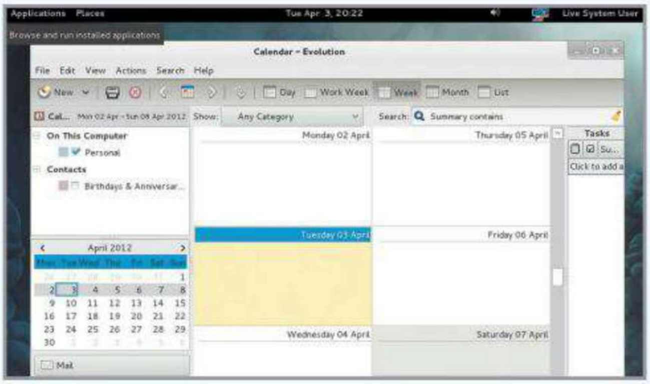
–Graham Morrison

There are literally hundreds of Linux distributions out there, and the list is growing weekly. The free software world is, after all, primarily one of choice, and that means developers can—and often do—scratch their own itches. Here are a few of the more notable distros and what they're most suited for.

PRODUCTIVITY: FEDORA 17

There's usually one distro you rely on more than any other. This is the distribution that's going to be used day-in, day-out, and often for essential-yet-mundane tasks such as email and writing documents. It makes sense for this distribution to be as streamlined, stable, and secure as possible, while still providing software support for the latest features.

Fedora sports serious open-source credentials, and each update skims off the cream of the latest updates and bundles them into a single, very well-tested distribution. The new release will also offer the best default user experience of the new Gnome desktop.


Applications Places
Tue Apr 3, 20:22
Live System User
Browse and run installed applications
Calendar – Evolution
File Edit View Actions Search Help
New
Day Work Week Week Month List
Cal... Mon 02 Apr - Sun 08 Apr 2012 Show: Any Category
Search: Summary contains
On This Computer
Personal
Contacts
Birthdays & Anniversar...
Monday 02 April
Thursday 05 April
Tuesday 03 April
Friday 06 April
Wednesday 04 April
Saturday 07 April
Tasks
Su...
Click to add a
April 2012
Mon Tue Wed Thu Fri Sat Sun
Mail

Fedora is an ideal distribution if you're looking at daily office tasks. You can try it easily, too.

HACKING: ARCH

Arch Linux has just celebrated its 10th anniversary, but only in the last couple of years has this DIY distribution started to gain serious traction. Compared to most other distributions, it has a tough learning curve that starts at installation. There's no graphical interface, and you're expected to add and configure everything manually. It's an old-school experience that brings a great feeling of satisfaction, as well as unrivaled knowledge of your system's configuration and Linux in general.

Arch uses a rolling release cycle, rather than one or two major updates a year. This means that when you install Arch, you always have the latest versions. Every package is cutting-edge, so your installation will surf as close to application and desktop releases as possible, without expecting you to compile the packages by hand. And while Arch can be tough, it's nowhere near as complex as a distro like Gentoo. Even a beginner could follow the excellent wiki instructions and come away with a working installation, and the community is one of the best and most helpful around.

The brilliant thing about Arch, and the reason we'd pick it for hacking and tinkering, is its Arch User Repository of packages. It's not officially supported, but it's massive and easy to contribute to. The AUR also makes it very easy to install packages from their source code, install their dependencies, and keep them up to date. This makes it perfect for experimentation.

SECURITY: TAILS 0.10.2

The big advantage of using Tails is that it boots into a Tor-enabled desktop. Tor is an anonymity network, and it works as a kind of random multistepped VPN, where your Internet connection passes through a variety of machines before appearing somewhere random, theoretically making it very difficult for anyone to retrace the route back to your IP address. As soon as you open the browser, you should be browsing anonymously.

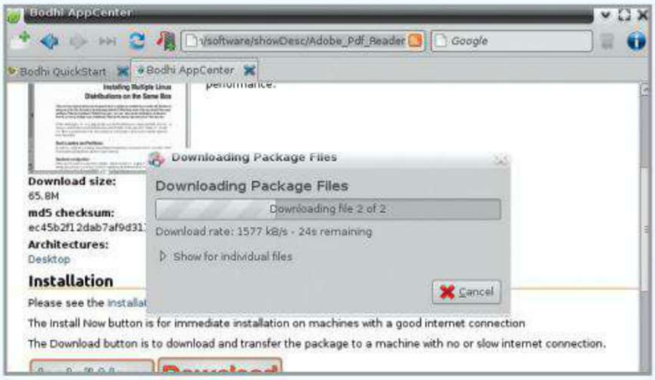
Tails includes many other tools to help with security and privacy. LUKS, for example, can encrypt your storage. Your email, instant messaging, and standard browsing can all be protected using a variety of other plugins, safeguarding you from potential changes in the local configuration, and because Tails is a live CD, as soon as you reboot or shut down your machine, all traces of your session are removed. Tails even takes care to blank your memory at shutdown, so there shouldn't be a single electron of data remaining.

SPEED DEMON: BODHI

From the boot menu, you get to choose from a selection of desktop configurations, from bare-bones to a design for netbooks, as well as an overall theme. Less than a second later, everything is configured. This speed and minimalism comes from a desktop called Enlightenment. Bodhi is one of a new breed of distros that opt for efficiency and minimalism over the perceived bloat of KDE and Gnome.

As a result, Bodhi has modest system requirements without sacrificing features. The Midori web browser, for instance, is very quick, and because it's built on WebKit, it can render the vast majority of sites to the same standard as Chrome and Safari. General applications are also quick to boot due to the distribution's low memory footprint.

You can't tell by looking at it, but Bodhi is built on Ubuntu, so you have access to the same broad selection of packages. There's also a good selection of packages that can be installed with a single click from the web browser. Just point it at http://appcenter.bodhilinux.com and click Install.


Bodhi AppCenter
/software/showDesc/Adobe_Pdf_Reader
Google
Bodhi QuickStart
Bodhi AppCenter
Downloading Package Files
Downloading file 2 of 2
Show for individual files
Cancel
Installation

Download size: 65.8M

md5 checksum: ec45b2f12dab7af9d31

Architectures: Desktop

Downloading Package Files

Download rate: 1577 kB/s - 24s remaining

Please see the Installat

The Install Now button is for immediate installation on machines with a good internet connection

The Download button is to download and transfer the package to a machine with no or slow internet connection.

Bodhi is a streamlined, superfast distribution designed for efficiency.

COOLER MASTER
www.coolermaster-usa.com
Seidon
240M
Seidon
120XL
Seidon
120M
LIQUID COOLING FOR THE MASSES
Maintenance Free - Factory Filled & Sealed
Silent Pump <25dBA
User & System Controllable Fans

WE HIGHLIGHT THE HARDWARE THAT GETS YOU THE MOST PERFORMANCE PER DOLLAR SPENT—NOW WHO CAN ARGUE WITH THAT?

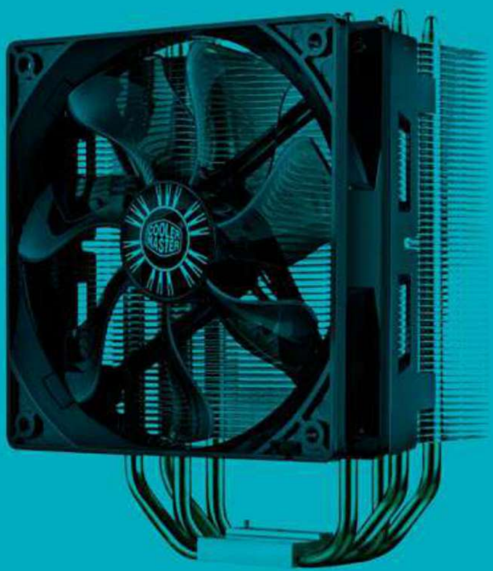
BY THE MAXIMUM PC STAFF

GET THE BEST BANG FOR THE BUCK!

We all know that, generally speaking, buying the newest top-end part gets you the most performance. But in most cases, the premium you pay for that part covers a whole lot of other stuff as well that has no bearing on frame rates or video encoding times. We're talking about the added cost of covering research and development, product marketing, lower production yields, etc. That high price also includes a vanity tax, if you will—the extra charge incurred by folks who simply want to have the latest hardware, hot off the fab, for bragging rights.

Splashing out on the very latest gear is all well and good, if you're rolling in cabbage. But for most of us, the job of choosing what part to buy is much more nuanced. The object is to find the hardware that offers the greatest value—the best price-to-performance ratio.

That's our objective here—to examine each of the major PC component categories, run the relevant benchmarks where warranted, and zero in on the coveted sweet spot. What we've come up with is a list of parts that are capable of meeting a typical enthusiast user's needs for the best price possible.



CPU

Intel Core i5-3570K

PAY FOR THE THREADS YOU NEED, NOT THE THREADS YOU WANT

Make no mistake, we love cores and threads. But when you start talking about bang for the buck and sweet spots, eight-core and six-core CPUs don't fit into the equation (well, unless you consider AMD's Bulldozer, but that's another matter). As power users who like to regularly drop in new CPUs, we have a personal fondness for the LGA2011 platform, but frankly, LGA2011 carries a price premium that the vast majority of users don't need to pay.

Really, when you talk about bang for the buck, it very much gets into the complicated question of just what kind of bang you're after. Are you a 100 percent gamer (a rare duck, in our book) or someone who spends most of his or her time pushing pixels professionally?

Since you pay for every thread in your system, you want to make sure they're actually working for you. Take a gander at our benchmark chart, which compares a six-core Core i7-3930K to the quad-core Core i7-3820. To see what impact threads have on the benchmarks, we turned Hyper-Threading on and off for both processors. The value of the threads are there—but only if you have multithreaded apps that can use them. For the most part, today's apps are optimized for quad-core or lower.

Based on our thread experiment, we believe we can make a case for Intel's $230 quad-core 3.4GHz Core i5-3570K chip sans Hyper-Threading. Ivy Bridge offers at least a 10 percent performance advantage over Sandy Bridge and the 3570K is unlocked. Keep in mind, if you run thread-heavy apps such as encoding or 3D rendering, you should pay for Hyper-Threading or move up to a six-core part, but the sweet spot today remains four cores.

WHERE'S AMD?

We know, why no AMD? To tell you the truth, we love AMD parts. The K6-2 was a spry chip. The Athlon saw David slay Goliath, and Athlon XP repeatedly made a mockery of the Pentium 4 during its run. The Athlon 64 and Athlon 64 X2 were such stunningly fast chips that we didn't see an Intel-based system for review for more than a year. See, we recognize AMD's glory days. But today, it's a different story. Intel firmly controls the high ground, middle ground, and would probably have run AMD out of the low ground if it wasn't so fixated on ARM-based CPUs today. Don't get us wrong, an AMD chip would be great in an entry-level box, but when the company's fastest eight-core processor can barely out-box Intel's last-generation quad-core (without Hyper-Threading enabled, mind you) it's hard to see a place for AMD processors except in the entry-level arena today.

intel
Ivy Bridge

This quad part offers Ivy Bridge performance and is unlocked for overclocking.

BENCHMARKS

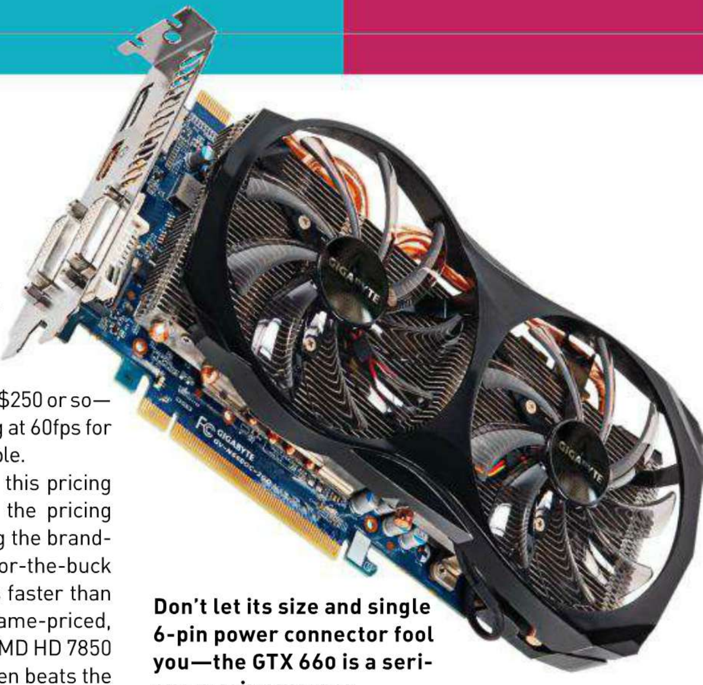
	3.4GHz Core i7-3930K with Hyper-Threading Enabled	3.4GHz Core i7-3930K with Hyper-Threading Disabled	3.6GHz Core i7-3820 with Hyper-Threading Enabled	3.6GHz Core i7-3820 with Hyper-Threading Disabled
Thread Count	12	6	8	4
Price	$583	$583	$294	$294
3DMark 11	X5,794	X5,703	X5,730	X5,669
3DMark 11 Physics	11,299	8,974	8,901	7,090
x264 HD 5.0 Pass 1 (fps)	85.8	51.9	62.8	51.6
x264 HD 5.0 Pass 2 (fps)	19	15.6	13.4	11.2
ProShow Producer 5.0 (sec)	1,553	1,500	1,565	1,546
STALKER Day (fps)	181	182	184.2	184.9
STALKER Night (fps)	206.5	211	206.5	206.5
STALKER Rain (fps)	240.7	238	240.7	236.4
STALKER SunShafts (fps)	159.2	158	161.2	160.4
Stitch.EFx (sec)	906	969	962	1,057
Cinebench 11.5 (score)	10.2	8.35	7.72	5.85
Valve Particle Benchmark (fps)	249	186	181	146
7Zip (MIPS)	29,748	21,655	21,122	15,767

We used an Asus Sabertooth X79 motherboard, 8GB of DDR3/1333, a GeForce GTX 690, and OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional for testing both CPU configurations.

VIDEOCARD

GeForce GTX 660

IT'S A TIGHT RACE BUT THIS RELATIVE NEWCOMER TAKES THE CROWN



Don't let its size and single 6-pin power connector fool you—the GTX 660 is a serious gaming weapon.

When you begin to compare price/performance ratios of GPUs at the high end of the scale, you typically see diminishing returns once you go beyond about $300. That's rarefied air up there, where 5–10 additional frames per second will cost you an extra $100 or so. The real battle for frames, frags, minds, and dollars exists below that price point, as the GPUs loitering in the mid-$200 region offer very good performance for literally half the price of the flagship videocards. This is the sweet spot—typically around $250 or so—where you can find 1080p gaming at 60fps for the least amount of money possible.

After examining the cards in this pricing segment, as well the cards in the pricing segment above it, we're granting the brand-new Nvidia GTX 660 best-bang-for-the-buck status. At just $230, this GPU is faster than the slightly more expensive (or same-priced, depending on where you shop) AMD HD 7850 by a respectable margin, and even beats the pricier $280 Radeon HD 7870 in some of our tests, making it the fastest GPU under $250 by a wide margin.

So, why not spend $70 more and get a GTX 660 Ti? Looking at the benchmark chart, you can see that extra money nets you some performance gains, but in our judgment you don't get enough of a return on that investment. The GTX 660 Ti costs roughly 25 percent more than a GTX 660, and yet offers an average of 15 percent performance improvement in most tests. When you tabulate price-per-fps, the GTX 660 also has the advantage over the GTX 660 Ti in the majority of tests we run, making it the value leader. As icing on the cake, you only need one 6-pin connector instead of the two that bigger cards require, so you're saving money in the PSU department, as well.

BENCHMARKS

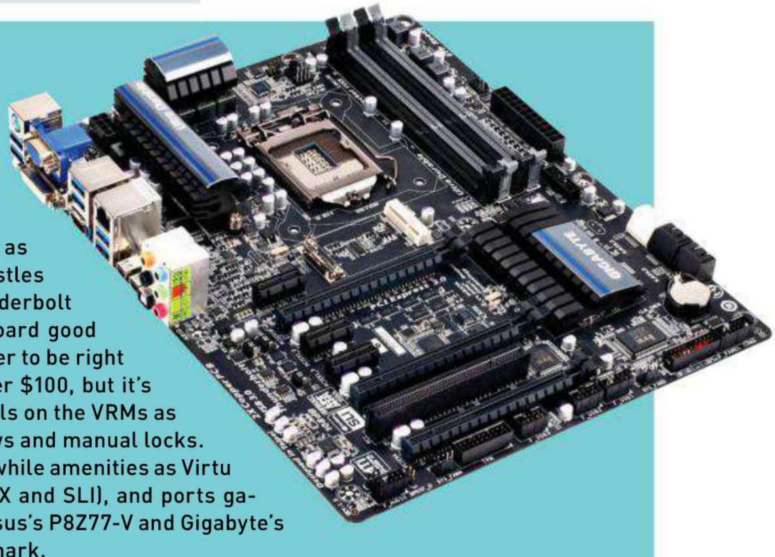
	Gigabyte GTX 660 OC Version	XFX Radeon HD 7850	EVGA GTX 560 Ti 448	XFX Radeon HD 7870 GHz	MSI GTX 660 Ti Power Edition
Price	$230	$245 (street)	$250	$280 (street)	$310
3DMark 2011 Perf	6,935	6,075	6,295	7,001	**9,118**
3DMark Vantage Perf	27,858	24,584	25,523	27,953	**31,575**
Unigine Heaven 2.5 (fps)	36	31	31.8	33.2	**39.8**
Shogun 2 (1080p, fps)	53.7	47	43.1	62.2	**71.1**
Far Cry 2 / Long (fps)	119	103	112.4	112.7	**133.3**
Dirt 3 (fps)	75.7	50	68.8	82.4	**95.1**
STALKER: CoP DX11 (fps)	42.8	34.7	38.4	42.6	**49.9**
Just Cause 2	60.3	51	55.8	59.6	**68**
Batman: Arkham City (fps)	76	60	64	72	**80**
Metro 2033 (fps)	22	23	22.6	**24.2**	22.3

Best scores are bolded. Our test bed is a 3.3GHz Intel Core i7 3960X Extreme Edition in an Asus P797X Deluxe motherboard with 16GB Corsair DDR3/1600 RAM and a Corsair AX1200 PSU. The OS is 64-bit Windows 7 Ultimate. All games were run at 1900x1200 with 4x AA unless otherwise noted.

MOTHERBOARD

GIGABYTE Z77X-UP4 TH

IT DOESN'T COST MUCH TO GO FROM STRIPPO MOBO TO FEATURE-RICH



When it comes to motherboards, you can seemingly spend as much as you want or as little. So, do you need a bells-and-whistles board like Asus's ultimate Z77 P8Z77-V Premium with its Thunderbolt and PLX chips for four-way GPUs, or is a $90 Z77 strippo board good enough? We find the sweet spot for a cost-conscious power user to be right about $190. Sure, you can get a microATX Z77 board for under $100, but it's usually stripped down to the barest of essentials, with thermals on the VRMs as an afterthought. It's like getting a new car with roll-up windows and manual locks. We think that by stepping up to about $190, you get such worthwhile amenities as Virtu hybrid-graphics support, multi-GPU support (both CrossFireX and SLI), and ports galore. Some good examples of bang-for-the-buck boards are Asus's P8Z77-V and Gigabyte's Z77X-UP4 TH. Both are feature-rich yet don't break the $200 mark.

SOLID-STATE DRIVE

Crucial M4 256GB

400MB/S READS, 250MB/S WRITES, LESS THAN $200

Not the newest nor the fastest, but good speeds for a good price.

Right now the sweet spot for solid-state drives is a 6Gb/s SATA SSD in a capacity near 256GB (240GB for a SandForce-based drive). Why 256? 256 is big enough to store your OS, programs, and several games, and many modern controllers are optimized for that capacity—SandForce SF-2281 controllers, for example, have 16 lanes, and a 240GB drive has 16 NAND modules. Best of all, thanks to this year's massive price drops, SSD prices are under a dollar per gigabyte: You can get a 256GB Samsung 830 Series, one of our favorite SSDs, for under $230.

So, which SSD offers the best value? Crucial's M4 SSD is a favorite of system builders for its relatively good performance and low price. It's not *the* fastest 6Gb/s SATA SSD, but it's plenty fast by any standard, and it's attractively priced. For $180 at the time of this writing, you can get a drive with sustained reads over 400MB/s, sustained writes over 250MB/s, and good random-read and -write performance, as well. For $20 more you get the OCZ Vertex 4, with reads and writes in the 440MB/s range and higher random IOPS, and for $50 more than the M4 you can get a Samsung 830 Series drive, with 500MB/s-plus sequential reads, 400MB/s writes, but lower random IOPS—which is fine, unless you're running a really active database server.

The specific drive you get will depend on current pricing, and (as is the case with most components) you can get a great drive for a little more than the cost of a very good drive, but right now we think the Crucial M4 is the sweet spot to beat.

BENCHMARKS

	Crucial M4	OCZ Vertex 4	Samsung 830 Series
Capacity	256GB	240GB	256GB
Price	$180	$200	$230
Price Per Gigabyte	$.70	$.83	$.89
Controller	Marvell 9174	Indilinx Everest 2	Samsung
CrystalDiskMark			
Sustained Reads (MB/s)	404.5	440.9	506.4
Sustained Writes (MB/s)	257.3	446.9	398.5
AS SSD			
4K Reads (IOPS)	5,091	6,632	5,513
4K Writes (IOPS)	13,837	17,159	14,412
Iometer			
4KB Random Writes, QD32	56,087	65,111	35,329

Our current test bed is a 3.1GHz Core i3-2100 processor on an Asus P8 P67 Pro (B3 chipset) running Windows 7 Professional 64-bit. All tests used onboard 6Gb/s SATA ports with latest Intel drivers.

HYBRID DRIVES

A SWEET SPOT UNTO ITSELF?

On the surface it might seem like a hybrid drive is itself a sweet spot, giving you SSD speeds in your most common tasks with the capacity of a standard hard drive. And, well, that's true. There are two basic types of hybrid drives. A true hybrid, like the Seagate Momentus XT, consists of a hard drive with onboard NAND cache and an algorithm that mirrors the most frequently accessed sectors of the hard drive to the cache. The current Momentus XT is a 2.5-inch drive that tops out at 750GB of storage with 8GB of cache and is a good choice for laptop owners who don't mind the $60 price premium over a standard 750GB drive.

The other type of hybrid—roll-your-own—is more accessible for desktop owners: Intel chipsets since Z68 have shipped with Smart Response Technology to allow users to add a cache drive, and many SSD vendors now ship low-capacity drives with Dataplex caching software. This is a good option for people who can't afford an SSD large enough to be its own boot drive, or who don't want the trouble of a reinstall—but there are limitations. SRT can only use cache drives under 64GB and the Dataplex software that ships with most cache SSDs won't work if the system drive has a GPT partition scheme or is over 2.2TB.

Either type of hybrid will speed up the "feel" of Windows—it'll boot faster and frequently accessed programs will launch much faster, but you won't get the massive speed boosts when copying files, and tasks you don't perform often won't feel the benefit at all. It's not quite the best of either world, but it's better than just rolling mechanical.

At 4.6 cents per gigabyte, you can't afford to pass up the Barracuda 3TB.

HARD DRIVE

SEAGATE BARRACUDA 3TB

THE BEST DRIVE IS ALSO THE BEST VALUE

It's weird to say this, but the sweet-spot hard drive is the same as the Best of the Best hard drive. The 3TB Seagate Barracuda is the best combination of price, performance, and capacity, whether you're using it as your only drive or as the backup for a boot SSD. Its sequential read and write speeds of over 150MB/s make it the fastest 7,200rpm drive we've ever tested, and its price of $140 means its per-gigabyte cost is only 4.6 cents, making it the best value on the market right now. By contrast, 2TB "Green" drives, which spin at around 5,900rpm, are around $120 from WD and Seagate right now. Why pay more per gigabyte for slower storage? Cost-per-gigabyte goes way up as size goes down, too, especially for any drive under 1TB.

If your budget can't stretch to $140 and you don't have an SSD, you'll want to prioritize performance over capacity. Get a 2TB Barracuda (make sure it's one of the two-platter 7,200rpm ones with 64MB of cache). At $100, that's 5 cents per gigabyte. 2TB WD Caviar Black drives, on the other hand, are over $200 at press time.

If you do have an SSD and you only have, say, $85 or $90, get the 1.5TB Barracuda Green from NCIX US. It's one of the few drives over 1TB that are under $100 right now, though we hope that changes as the industry recovers.

Whether Seagate is engaged in a price war or it just fared better in the Thailand floods of last year, its drive prices are unbeatable at press time, and the 3TB Barracuda is by far the most screaming deal.

SPECIFICATIONS

	Price	Price Per Gigabyte	Spin Speed (rpm)	Cache (MB)
3TB Seagate Barracuda	$140	0.047	7,200	64
1.5TB Seagate Barracuda Green	$70	0.047	5,900	64
3TB WD Caviar Green	$148	0.049	5,400	64
2TB Seagate Barracuda	$100	0.050	7,200	64
2TB Seagate Barracuda Green	$100	0.050	5,900	64
1.5TB Seagate Barracuda	$82	0.055	7,200	32
2TB WD Caviar Green	$110	0.055	5,400	64
3TB HGST Deskstar	$200	0.068	7,200	64
1TB WD Caviar Blue	$83	0.083	7,200	32
1TB Seagate Barracuda	$86	0.086	7,200	64
1TB WD Caviar Green	$89	0.089	5,400	32

CASE

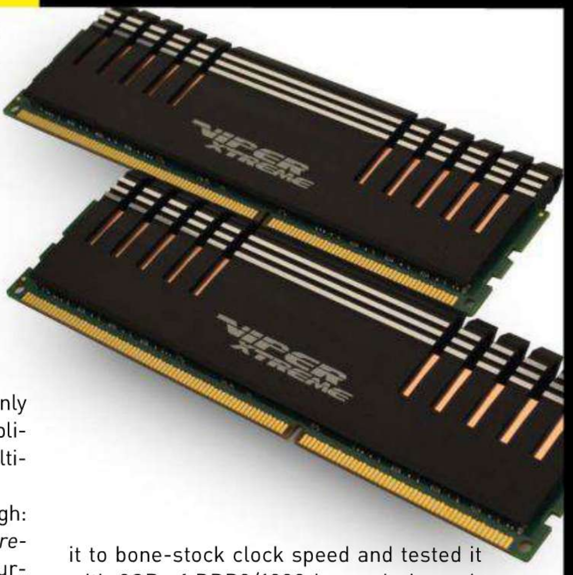
NZXT PHANTOM 410

THERE'S NO NEED TO PAY MORE FOR A SOLID ENCLOSURE

There are people who say that the case doesn't matter, that the sweet spot for cases is "as cheap as you can possibly get." These people are bad and they should feel bad. The sweet spot for cases is right around $100. At $100, you can get a great mid-tower or full-tower case with solid build quality, plenty of fans or fan mounting options, front-panel USB 3.0, toolless drive bays, and a nice paint job. Below that you'll sacrifice build quality or looks, and above that you start getting fancy, with water-cooling mounts, support for giant motherboards or a half-dozen fans, or premium materials, but $100 will get you a case with good air cooling that you can be proud of.

Our favorite cases at $100 are the Fractal Design Define R4 and the NZXT Phantom 410. The Define R4 is the more flexible of the two. It's more of a silent PC by design, with its acoustic foam on the inside of the side panels and its unused fan holes covered with sound-damping material until removed to add fans. The Phantom 410 looks stunning, especially in red or gray, and comes with much more fan support and more fans, flat out.

These aren't the only cases at $100 and below that are worthy of consideration, but they're two of our favorite mid-towers and they both happen to be around the $100 sweet spot.



8GB is truly the new 4GB when it comes to RAM.

RAM

8GB DDR3/1600 OR DDR3/1866

THE SWEET PLACE TO BE IS IN DUAL-CHANNEL MODE

How much RAM do you need, how many channels, and what speed? From our experience, and based on today's RAM prices and capacities, we recommend 8GB of DDR3/1600. Everyone knows that 2GB is not enough RAM today. And while 4GB is OK, why stop there when 8GB isn't much more? At press time, 8GB of DDR3/1600 fetched roughly $40 while 4GB is about $30.

Should you buy more RAM than that? Only you can answer that question. If your applications are RAM hogs or you tend to multitask, additional RAM can't hurt.

There's one more pesky problem, though: How many memory channels do you *really* need? Is it worth paying the extra surcharge for a quad-channel setup or is dual-channel enough? To find out, we took our trusty LGA2011-based zero-point, set it to bone-stock clock speed and tested it with 8GB of DDR3/1333 in quad-channel, dual-channel, and, well, single-channel, using various benchmarks. Some of the benchmarks are GPU-limited and others are CPU-limited to make a point that memory bandwidth won't make a difference in many of your applications. Stepping from quad to dual doesn't hurt much, but going to single will definitely take a bite out of performance, although not as much as you would suspect. In fact, upping the memory speed from DDR3/1333 to DDR3/1866 actually erased the difference in the apps that seem to like bandwidth the most: encoding.

Why does memory bandwidth make nary a difference in the vast majority of apps? Thank the huge caches in today's CPUs. The only time you really want to go all-out on memory bandwidth is when you're intending to game with integrated graphics.

BENCHMARKS

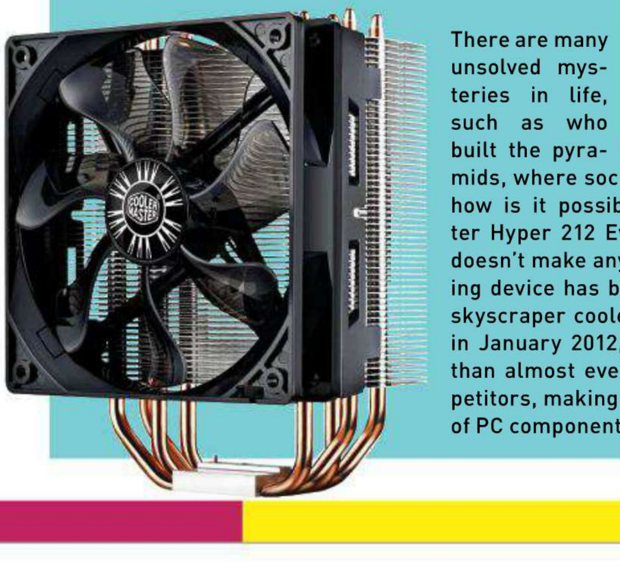
	Quad-Channel	Dual-Channel	Single-Channel
3DMark 11 overall	X5,794	X5,764	X5,634
x264 5.0 HD Pass 1 (fps)	85.8	83.4	74.4
x264 5.0 HD Pass 2 (fps)	19	18.9	18.8
SiSoft Sandra (GB/s)	34.2	17.6	9.0
Stitch.Efx (sec)	906	898	919
ProShow Producer 5.0 (sec)	1,553	1,586	1,732
Cinebench 11.5	10.2	10.2	10.02

We used an Asus Sabertooth X79 motherboard, 8GB of DDR3/1333, GeForce GTX 690, OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional for testing both CPU configurations.

AIR COOLER

COOLER MASTER HYPER 212 EVO

THE BEST COOLER-FOR-THE-COIN WE'VE EVER TESTED



There are many unsolved mysteries in life, such as who built the pyramids, where socks go during laundry, and how is it possible that the Cooler Master Hyper 212 Evo costs only $35. It just doesn't make any sense. This simple cooling device has bested the majority of our skyscraper coolers since it was reviewed in January 2012, and yet it has cost less than almost every single one of its competitors, making it a rare gem in the world of PC components.

What about water cooling? We're not going to go there, simply because even though the all-in-one designs have radically simplified the installation and maintenance of cooling loops, their price-to-performance ratio is still not as good as what's available from a solid air cooler. In fact, in some cases the bigger air coolers perform better than their liquid brethren while costing less, so the sweet spot for now is definitely on dry land.

BENCHMARKS

	CM Hyper 212 Evo	Xigmatek Aegir	Noctua DH-14	Corsair H100 LCS
Price	$35	$60	$85	$115
Ambient Air	23.8	24.8	25.2	25
Idle Temperature	36.2	33.8	34.1	33.2
Burn Temperature	74	**71**	72.3	69.2
Temp Delta (Burn minus idle)	37.8	37.2	41.1	**36**

All temperatures in degrees Celsius. Best scores bolded. All tests performed using an Intel Core i7-3960 at 4.2GHz, on an Asus P9X79 Deluxe motherboard with 16GB DDR3/1600, in a Thermaltake Level 10 GT with stock fans set to High.

PSU

CORSAIR CX600

BUY JUST ENOUGH PSU FOR YOUR NEEDS

CORSAIR
CX600

Our normal advice for an enthusiast constructing a system is to think long term, overbuild because you don't know what parts your machine will end up with, and consider how hard your PSU is working on those sweltering days of summer. And if we were making a recommendation for someone using our guidelines, we'd say buy a Corsair TX 750 V2 or Thermaltake Smart 730. Both are about $100, give you a nice long five-year warranty, and offer four 6+2 connectors for future beefy-GPU support.

But this story is about bang for the buck, and with today's sweet-spot GPUs offering pretty fantastic power envelopes, we surprised even ourselves by stepping down in PSUs. Corsair's $70 CX600 V2 provides 600 watts and two 6+2 GPU power connectors. The PSU has plenty of power to run a single-GPU machine, no problem, and even SLI if you keep the system properly cooled. Be aware, if you plan to vary from our sweet-spot GPU, the TX 750 V2 is recommended instead.

BEST BOX FOR THE BUCK

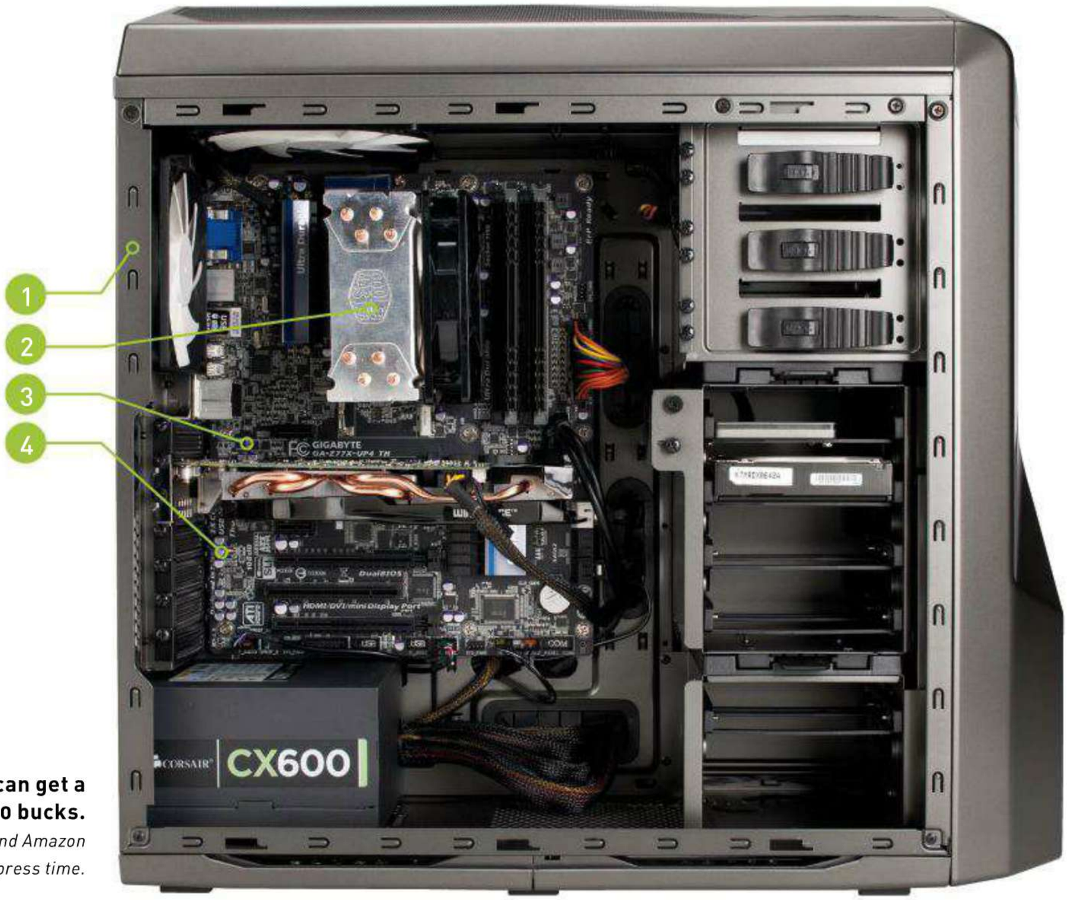
WHEN YOU PUT ALL THESE GREAT-VALUE PARTS TOGETHER, YOU END UP WITH ONE SWEET PC

1. The NZXT Phantom 410 easily accommodates all our parts, with room to spare for expansion. The Gunmetal paint job looks hella tough, too.

2. With an Intel Core i5-3570K onboard and the cooling prowess of the Cooler Master 212 Evo, you'd be a fool not to overclock.

3. The GTX 660 lets us connect to a 1080p panel and get 60fps with all settings maxed out.

4. Gigabyte's Z77X-UP4 is SLI-friendly, so commence saving your shekels for that second card.



Proof positive you can get a lot of bang for 1,200 bucks.

Cost reflects NewEgg and Amazon prices at press time.

SWEET SPOT HALL OF FAME

THEY CAPTURED OUR HEARTS WITH A COMBO OF KICK-ASS PERFORMANCE AND KILLER PRICE

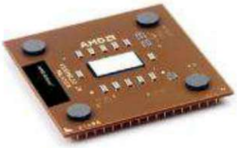
Image Credit: Wikipedia

CELERON 300A

At the Bang-for-the-Buckers reunion, there will always be a seat reserved for Intel's Celeron 300A. The "Celery" 300A's claim to fame was an almost guaranteed overclock from 300MHz to 450MHz. You scoff today, but that difference let you get performance similar to a $670 450MHz Pentium II, but for only $150.

NVIDIA GEFORCE 8800 GT

How great was the $250 GeForce 8800 GT? It was faster than the next card up the ladder and damn near as fast as the one a rung above that. It was so popular that Nvidia will still refer to a new card in its lineup as the "GeForce 8800 GT" of the litter.



AMD CPUS

We're going to break form here by declaring AMD CPUs bang-for-the-buckers. Which one? Just pick any, because nearly all of them qualify. Yes, AMD is out of the hunt right now, but in general its chips have always been incredibly price competitive and have kept Intel's prices far more reasonable.

COOLER MASTER HYPER 212 PLUS

Cooler Master's famous Hyper 212 Plus proved that an excellent cooler didn't have to cost a claw and a tendril. The amazing thing is that the $25 Hyper 212 Plus was as good as 90 percent of the pack that cost twice as much, and it came pretty darn close to the best performers, too.

ANTEC 900

You're probably spoiled by today's $100 enclosures, but years ago, all a hundy would get you was a razor-blade-shaped box made from recycled roller skates. The P900 gave you incredible bang for the buck and nearly a full set of fans instead of the typical 10-exhaust-ports-but-just-one-fan routine.

ABIT BP6

Dual-proc men (and women) have always gotten gouged on price—you literally had to pay for the privilege of running two processors. Abit's BP6 shattered that price lock by giving you a dual-proc board that let you run and overclock two Socket 370 Celerons—a config the Celery was never supposed to support!

NVIDIA GEFORCE 4 TI 4200

Before the GeForce 8800 GT, there was the GeForce 4 Ti 4200. The 4200's hallmark was that despite Nvidia intentionally Nerfing the card to keep it from competing with higher-end cards, card vendors ignored the clock-speed directive and sold boat loads of them, all but killing its sibling, the Ti 4400.

intel
Core 2 Quad

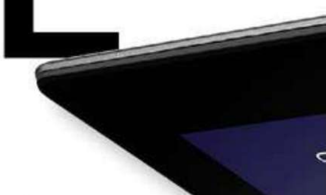
INTEL CORE 2 QUAD Q6600

The sweet spot in CPUs always seems to be near the $250 mark. At $266, the 2.4GHz Core 2 Quad Q6600 was exactly the same as the $1,000 2.93GHz Core 2 Extreme QX6800 in cache and front-side-bus speed. Oh, and it overclocked just fine, thank you.

BY KATHERINE STEVENSON, GORDON MAH UNG, AND TIM FERRILL

WINDOWS 8 HARDWARE

MICROSOFT'S RE-IMAGINED OS IS ONLY HALF THE EQUATION



Yes, Windows 8 can be a very unsettling experience for longtime Windows users. It's like going to visit your parents and finding dad decked out in drag. The person you've known for so long is still there, but a new, unexpected element to his persona has you flummoxed and fumbling for how to behave.

The big, blocky, colorful, touch-centric Modern UI (the official name, according to Microsoft) seems about as natural to a desktop jockey as seeing pops in a bouffant blonde wig and a body-hugging velour pantsuit. But while adjusting to dad's new way of life could take considerable time, and possibly therapy, adapting to Windows 8 might simply be a matter of having the right hardware.

Windows 8 is a new OS for a new way of computing. Obviously, mobile is a big part of that. Microsoft's Surface RT tablet as well as a host of portables combining tablet and notebook qualities in one have been built expressly with Windows 8 in mind. But there's also hardware that makes Windows 8 more agreeable for tower users—touchscreen monitors, touchpads, Win8-optimized mice and keyboards. On the following pages we take a look at several of these products to determine which ones succeed in making sense of Windows 8.

MICROSOFT SURFACE RT

Software giant takes on tablets

MICROSOFT IS THOUGHT of only as a software company by most, but people often forget the company's long string of hardware victories over the years, such as the Xbox 360, as well a line of award-winning and coveted mice, game controllers, and keyboards.

Frankly, we think you can add the Surface RT to that list of impressive hardware pieces. The Surface RT exudes luxury with its stylized and solid-metal case, clever kickstand, magnetic power connector (a first on a tablet that we know of), and innovative keyboard cover.

Windows RT—the pared-down Windows 8 OS in the Surface RT—and its Modern UI (née Metro), makes for a truly unique (god help us) "reboot" on how you interface with a touch-enabled computer. Yes, by bucking the rows of icons we've used for years now to interface with touch, the learning curve is steeper, but there's something enjoyable and refreshing about Windows' new tiled UI.

For hardware, the Surface RT packs an Nvidia Tegra 3 part clocked at 1.4GHz, 2GB of LP-DDR3, 32GB (or 64GB) of storage, front and rear cameras, and a 10.6-inch 1366x768 screen. Given the RT's premium price, Microsoft has taken dings for the screen's resolution. With the fourth-gen iPad's resolution at 2048x1536 and the Nexus 10's at 2560x1600, it's no surprise that people see the relatively low resolution of Surface RT as a minus. In practical use, it won't kill you, but there will be times when you wish the Surface RT had a few more pixels to smooth things out.

Performance of the Surface RT is difficult to gauge, as there are no standardized benchmarks that can be run outside of the browser on the iPad, Nexus, and RT. We did run several browser-based benchmarks, but obviously, you're not getting that close to the metal and each platform's browser has a significant impact on performance. If pushed to make a call, we'd say it's a split in the numbers game, as each device won at least one benchmark. Using our Mk. 1 eyeball as a benchmark, the Surface RT didn't feel slow in the apps we tried and the scrolling seemed creamy-smooth—certainly better than the severe stutter we experienced on pre-Jelly Bean Androids tabs. One thing that's apparent, though, are the slow application launches. It takes from five to six seconds to launch the most basic apps, which is unacceptable on a premium tablet. Once cached, it's fine, but the initial launch is s-l-o-w.

A clever kickstand lets you stand up the Surface RT for movie viewing or typing on the optional keyboard.

The Surface is sexy-thin and its hard angles are refreshing in a world of soft-round-cornered gadgets.

While we're harping on hardware, we'll also ding the camera used in the Surface RT. Both front and rear are 720p, which is pretty sad in this day and age, but maybe that will dissuade people from embarrassing themselves by using the tablet as a camera. Another hardware issue worth mentioning: The 32GB version we reviewed is about half spent on OS storage. That's fortunately mitigated by the inclusion of a MicroSD slot, so an additional 64GB is just one Amazon click away.

The most impressive feature of the tablet is the integrated keyboard cover. Two versions are available: a 5.75mm thick Type Cover that uses mechanical keys and a 3mm Touch Cover that uses membrane "keys" that don't move at all. We purchased the Touch Cover with our Surface RT and initially worried that it would remind us of the Atari 400 keyboard. Surprisingly, it wasn't that bad and we could comfortably type on it once we became accustomed to it. The track pad, however, is too small. Both covers attach via a clever magnetic connector that's strong enough to hold the weight of the Surface RT when picked up by the cover.

Some people have criticized the inclusion of a keyboard as a sign of weakness in the Windows RT OS. We strongly disagree. First, you don't get the keyboard for free—you have to pony up $120 for the Touch Cover and $130 for the Type Cover. Ouch. There's also no strong emphasis on the keyboard in the OS. You can navigate perfectly fine using just touch.

What we do have problems with is the OS. We, again, think Modern, or whatever you want to call it, is a refreshing and futuristic take on a touch interface, but Windows RT is marred by minor irritations such as nonuniform controls in the applications (some apps feature a back button, and some don't) and difficultly controlling some aspects of the OS. Our biggest complaint, though, is that portions of the OS aren't finished. For the most part, 90 percent of the OS is in the fat-finger-friendly Modern UI. But doing something as common as changing the power mode drops you into the desktop mode. And while still surprisingly easy to manipulate with your finger, the desktop mode is jarring—why, in a touch-centric device, would you force someone to use a non-touch UI? It's just surprising to us that Microsoft relegates so much of

Two keyboard options are available: a "real" keyboard (seen here) and a membrane keyboard that actually isn't Atari 400–bad.

the control in Surface RT to the desktop mode. Want to use basic calculator functionality? Do it desktop mode.

From what we can see, Windows RT is just a recompile of Windows 8 for ARM. Want a DOS box? Got it. Manually make regedit changes? That's there, too. It's simply mind-blowing for anyone coming from the four rubber walls of iOS, or the slightly less confining environs of Android. Don't get us wrong, we like command lines and tweaking the guts of an OS and we know it's there in iOS and Android, too—it's just a little disconcerting to have it so prominent in Windows RT.

We suppose there's some strength here. If a large company could port its custom Win32 app to Windows RT, the desktop mode would be a seamless way to transition to a tablet. Unfortunately, apparently only Microsoft has permission to install applications for the desktop mode, so what's the point of even having it? To us, this makes the real competition for Surface RT its x86-based brothers. With the barren shelves of the Metro app store, x86-based Windows 8 tablets at least give you the fallback of millions of Win32 apps already out. With Surface RT and a keyboard at $600 versus a full-on x86-based tablet such as Acer's Iconia W510 hybrid at $750 with a keyboard dock, it ain't pretty.

Ultimately, we're impressed by the Surface RT. Yes, it has some rough spots, and yes, the app store looks like a grocery store after the zombie apocalypse has hit (we expect that to change rapidly), but this is a very good first effort with a lot of potential for those who are willing to risk the burn of being early adopters and are free to think different. **–GU**

VERDICT

8

Microsoft Surface RT

$600, www.microsoft.com

BENCHMARKS

	Surface RT	Nexus 7	iPad 3rd-Gen
CPU	Quad-core 1.4GHz Nvidia Tegra 3	Quad-core 1.2GHz Nvidia Tegra 3 T30L	Dual-core 1GHz Apple A5X
GPU	520GHz Nvidia ULP GeForce	416GHz Nvidia ULP GeForce	PowerVR SGX543MP4
RAM	2GB	1GB	1GB
Screen Size / Resolution / PPI	10.6 inches / 1366x768 / 148	7 inches / 1280x800 / 216	9.7 inches / 2048x1536 / 264
Dimensions / Weight	10.81x6.77x0.37 / 1.5 lbs.	7.7x4.7x10.4x.4 / .74 lbs	9.5x7.3x.37 / 1.44 lbs.
SunSpider JavaScript 0.9.1 (ms)	**982**	1,702	1,519
Google Octane V1	700	**1,307**	881
Futuremark Peacekeeper	366	461	**465**
BrowserMark	80,558	**126,618**	117,980
Microsoft Fishbowl HTML5 / 10 Fish (fps)	23	21	**60**

Best scores are bolded.

LENOVO IDEAPAD YOGA 13

Bend it to your will

The Yoga 13's rubberized surfaces make it a pleasure to hold.

LENOVO GOT A HEAD start generating interest in the IdeaPad Yoga 13 when it demo'd the device at last year's CES. At that time, its unique ability to be both an Ultrabook and a tablet seemed like a far-out concept, today its "convertible" design is the perfect justification for Windows 8—and just one example of a whole new category of portable devices. As the name implies, the Yoga 13 is unusually flexible, able to assume four different positions of functionality, thanks to its special patented double-hinge. In notebook mode it's your standard clamshell; in stand mode the keyboard is rotated back and out of the way, forming a base for the screen; in tent mode the hinge is at the apex, with the screen in front and the keyboard serving as a kickstand; and in tablet mode the screen is flattened against the back of the keyboard. In all instances where the physical keyboard isn't intended for use, it's automatically disabled, with an onscreen keyboard taking its place.

The Yoga's screen is a 13.3-inch 10-point multitouch panel with 1600x900 resolution and the slimmest of bezels, so there's nothing getting in the way of your "swiping" in from the edges in Windows 8 fashion. Regardless of your opinion on touchscreens, you gotta love the fact that IPS panels seem to be the norm here, as opposed to the inferior TN panels that have been typical of standard, non-touch Ultrabooks. It makes sense—a device that's meant to be flipped and turned and viewed from a variety of orientations needs the better image fidelity of IPS. Yay for that.

The screen not only looks good but is very responsive. Even in desktop mode, our touches to the relatively small file/folder names, menu items, and commands were registered with pretty consistent accuracy.

Still, we were more inclined to perform desktop chores the old-fashioned way, and fortunately, the Yoga accommodates with a nice, comfortable keyboard and buttery-smooth touchpad that itself supports Windows 8 gestures. Indeed, as an Ultrabook, the Yoga 13 is pretty nice for the price. We might have been even more impressed if we hadn't just reviewed CyberPower's $850 Zeus M2 last month, which had nearly the same specs but performed 10–20 percent faster than the Yoga in all tests, except Quake III, where the Zeus M2 was 75 percent faster (the Yoga can thank its single-channel RAM for that defeat). Why such disparity between two Core i5-3317Us? The Yoga has a tendency to throttle down under load, presumably to maintain thermal levels.

Be that as it may, you're buying the Yoga 13 for more than just an Ultrabook experience. While a 13.3-inch, three-and-a-half-pound notebook folded back upon itself is pushing the limits of a tablet (as is the sensation of a keyboard on the back), the flexibility offered by the Yoga 13's form factor and touch capabilities has definite uses, not the least of which is giving Windows 8's split personality meaning. **–KS**

VERDICT 9

Lenovo IdeaPad Yoga 13

$1,000, www.lenovo.com

BENCHMARKS

	ZERO-POINT	
Premiere Pro CS3 (sec)	840	1,140 (-26.3%)
Photoshop CS3 (sec)	100	116.3 (-14%)
ProShow Producer (sec)	1,122	1,409 (-20.4%)
MainConcept (sec)	1,901	2,419 (-21.4%)
Quake III (fps)	358.2	250.1 (-30.2%)
Quake 4 (fps)	76.1	59.2 (-22.2%)
Battery Life (min)	250	282

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point ultraportable is an Intel reference Ultrabook with a 1.8GHz Intel Core i5-3427U, 4GB of DDR3/1600 RAM, integrated graphics, a 240GB SSD, and Windows 8 64-bit.

SPECIFICATIONS

CPU	1.7GHz Core i5-3317U
RAM	4GB DDR3/1600 single-channel
Display	13-inch 1600x900 IPS LCD
Storage	Samsung 128GB SSD
Connectivity	HDMI, USB 3.0, USB 2.0, 2-in-1 card reader, 802.11n, Wi-Fi, Bluetooth 4.0, headphone/mic, 720p webcam, USB-to-Ethernet dongle
Lap / Carry	3 lbs, 6.5 oz / 4 lbs, 0.6 oz

DELL XPS 12

A premium Ultrabook with a twist

The XPS 12 came loaded with top-notch hardware, but no Ethernet port or media reader.

LIKE THE YOGA 13, Dell's XPS 12 is an Ultrabook convertible, but it moves from clamshell device to tablet in an entirely different way. Push in on the lower back of the screen with both hands and it rotates in its frame to face backward—then just close the lid and you have a tablet. We like how this design hides the keyboard from sight, and feel, but we can't help but wonder how the rotating screen and thin metal frame will fare over time and with regular use. Dell says it's been tested to 20,000 cycles.

With its 12.5-inch screen, the XPS 12 is a bit smaller than Lenovo's Yoga 13, but it weighs the same three pounds, 6.5 ounces (without its power brick) as its peer, which again, makes it a more sedentary type of tablet. We're not saying you can't benefit from being able to fold up this Ultrabook, rest it atop your lap, and surf the web from your couch while you watch TV, tablet-style. We're just pointing out that it's larger and more unwieldy than even a 10-inch iPad.

Size issues aside, the XPS 12's 1920x1080 IPS screen is crisp and bright and its edge-to-edge Gorilla Glass coating should make it plenty durable. Capacitive sensors enable prompt response to all the various touches and swipes in Windows 8, even in desktop mode. Dell was kind enough to include a "Getting Started with Windows 8" app in the Modern UI, which explains how to navigate the OS—a feature that's sorely lacking from Windows 8 itself. Like the Yoga 13, the XPS 12's touchpad also supports Win8 gestures, so you can, say, swipe in from the right of the pad to expose the Charms bar, or swipe in from the left of the pad to switch programs. This worked most of the time, although not quite as reliably as with the Yoga. The physical keyboard is suitable for productivity, with nicely sized and spaced keys and a pleasant rubberized palm rest. It's also backlit with blue LEDs.

The XPS 12 starts at $1,200 for a config similar to the Yoga 13. But Dell sent us its most fully loaded model, which costs quite a bit more at $1,700. It consists of a 1.9GHz Core i7-3517U, 8GB of DDR3/1600 RAM, and a 256GB SSD. It's a pretty similar build to our zero-point Ultrabook and the two machines traded modest wins in all of our benchmarks.

While the XPS12 is handsome and has admirable parts, it strikes us as falling shy of the mark by being too cumbersome to fully satisfy as a tablet and too pricey to fully satisfy as an Ultrabook. **–KS**

VERDICT

8

Dell XPS 12

$1,700, www.dell.com

BENCHMARKS

	ZERO-POINT	
Premiere Pro CS3 (sec)	840	900 (-6.7%)
Photoshop CS3 (sec)	100	
Proshow Producer (sec)	1,122	1,064
MainConcept (sec)	1,901	1,902 (-0.1%)
Quake III (fps)	358.2	345.3 (-3.6%)
Quake 4 (fps)	76.1	72.3 (-5.0%)
Battery Life (min)	250	207 (-17.2%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

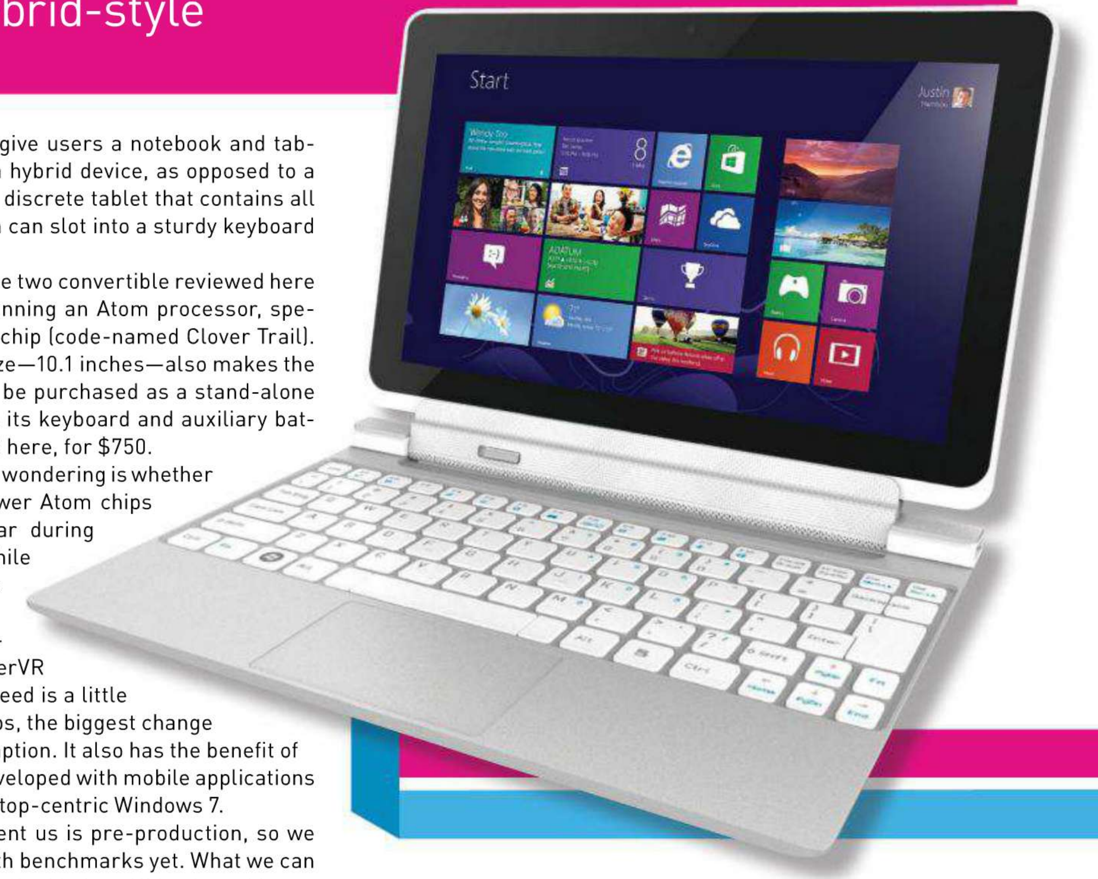
Our zero-point ultraportable is an Intel reference Ultrabook with a 1.8GHz Intel Core i5-3427U, 4GB of DDR3/1600 RAM, integrated graphics, a 240GB SSD, and Windows 8 64-bit.

SPECIFICATIONS

CPU	1.9GHz Core i7-3517U
GPU	Intel HD4000 integrated graphics
RAM	8GB dual-channel DDR3/1600
Display	12.5-inch 1920x1080 IPS LCD
Storage	Micron 256GB SSD
Connectivity	2x USB 3.0, Mini DisplayPort, 802.11n, Wi-Fi, Bluetooth 3.0, headphone/mic, 1.3MP webcam
Lap / Carry	3 lbs, 6.5 oz / 4 lbs, 0.6 oz

ACER ICONIA W510

A two-fer, hybrid-style



Batteries in both the keyboard base and the screen/tablet keep the W510 supplied with plenty of juice.

ACER'S ICONIA W510 also aims to give users a notebook and tablet in one, but it's what's called a hybrid device, as opposed to a convertible. This means there's a discrete tablet that contains all the brains of the operation, which can slot into a sturdy keyboard base as needed.

The Iconia W510 differs from the two convertible reviewed here in another significant way. It's running an Atom processor, specifically Intel's Z2760 system-on-chip (code-named Clover Trail). That combined with its smaller size—10.1 inches—also makes the W510 a lot less expensive. It can be purchased as a stand-alone tablet for $500, or complete with its keyboard and auxiliary battery base, like the model featured here, for $750.

Of course, what you're no doubt wondering is whether Atom sucks. Intel's ultra-low-power Atom chips got a reputation of being subpar during the rise of netbooks, which, while low-priced, were known for weak performance. The Z2760 is a 1.8GHz dual-core chip with Hyper-Threading and non-Intel PowerVR graphics. While the base clock speed is a little bit higher than previous Atom chips, the biggest change is reported to be in power consumption. It also has the benefit of running Windows 8, which was developed with mobile applications in mind, unlike the decidedly desktop-centric Windows 7.

Unfortunately, the unit Acer sent us is pre-production, so we can't test Atom's performance with benchmarks yet. What we can tell you is that the W510 booted to the Modern UI in about 16 seconds. Once there, horizontal scrolling through the interface was surprisingly smooth, but vertical scrolling, as on web pages, was inconsistent, with periodic lags. Still, we have to say we were surprised that the sucktastic qualities of old Atom were not apparent. We did experience a few quirks that we're attributing to its pre-production state, so we're going to give Acer the benefit of the doubt and assume these issues will be fixed in the final product. It's an intriguing concept, so we'd like to see it polished.

As a tablet, the Iconia W510 is far more convincing than either the Yoga 13 or the XPS 12. Freed from its keyboard, the W510 weighs just one pound, four ounces. The 10.1-inch screen is easy to hold in one or both hands, and while its 1366x768 resolution isn't going to win any contests, it's got the nice image quality of an IPS panel, under a protective layer of Gorilla Glass.

As a notebook, the experience is more compromised. For starters, the device is top-heavy, what with all the computing components stuffed into the screen, so it has a tendency to topple backward when it's sitting in your lap. Then there's the somewhat cramped keyboard, which isn't great for long bouts of typing. And its 64GB of storage is all too tablet-like for our tastes (a media reader and USB port make expansion possible). Also, its touchpad isn't great. Not only does it not support Win8 gestures, but it was noticeably less responsive than either Lenovo's or Dell's.

Still, we think this device has potential if the quirks we experienced are worked out in the final product. It's a believable tablet with far more productivity chops than other tablets offer—at least until Surface Pro arrives—at down-to-earth pricing. **–KS**

Acer Iconia W510

$750, www.acer.com

SPECIFICATIONS

CPU	1.5GHz Intel Atom Z2760 SoC
GPU	PowerVR SGX540
RAM	2GB DDR2/800
Display	10.1-inch1366x768 IPS LCD
Storage	64GB SSD
Connectivity	Micro HDMI (with dongle for VGA), Micro USB 2.0 (with dongle for full-size USB 2.0), Micro SD card reader, 802.11n, Wi-Fi, Bluetooth 4.0, headphone, mic, keyboard dock with USB 2.0
Lap / Carry (with dock)	With dock: 2 lbs, 12.4 oz / 3 lbs, 0.2 oz; tablet only: 1 lb, 4 oz

ACER T232HL

Doesn't come with a bottle of Windex

Step back, Modern UI haters, this multitouch panel won't break the bank.

WHAT MAKES A monitor "good" for Windows 8? First, you need a touch panel with a flush bezel that lets you summon the various Windows 8 command ghosts. That pretty much eliminates optical-based monitors, which have the camera lenses hidden in the corners. Microsoft also recommends no less than five-finger multitouch for the OS, but 10-finger is advisable.

That's all good news for Acer's new 23-inch T232HL touch panel. This 10-point-touch projected-capacitive panel lets you do all the Windows 8 swiping and flicking your heart desires. As you can imagine, projected capacitive carries a price premium and the Acer streets at $500—compared to, say, the $280 that a 23-inch optical touch panel might cost you. That's a big price increase, but certainly not as pricey as the InnovaTouch (reviewed next).

Running the panel through the Lagom LCD monitor obstacle course (www.lagom.nl), the Acer was good in most of the tests but we did see banding in the gradient tests. That issue wasn't in just synthetic tests, either—using a real-world product shot of a system, we could see the banding in one particular fade in the background. It's not terrible, and some might accuse us of pixel-peeping but the issue was noticeable compared with the InnovaTouch monitor. A series of digital images also looked less impressive on the Acer than the InnovaTouch—not to a great degree, but again, worth noting. The InnovaTouch also wins in responsiveness over the Acer, exhibiting less lag in response to touch commands.

Where the Acer excels is in ports—you get DVI, VGA, HDMI, and three USB 3.0 ports vs. the VGA and DVI on the InnovaTouch. The Acer is also far sexier, though we're not totally sold on the design. Neither panel is height-adjustable.

Despite all this, we think the Acer is a pretty decent panel for the price. It's IPS and, more importantly, it's a flush-bezel multitouch, which will make even the Win8 Modern UI haters reconsider their position. **–GU**

VERDICT 7

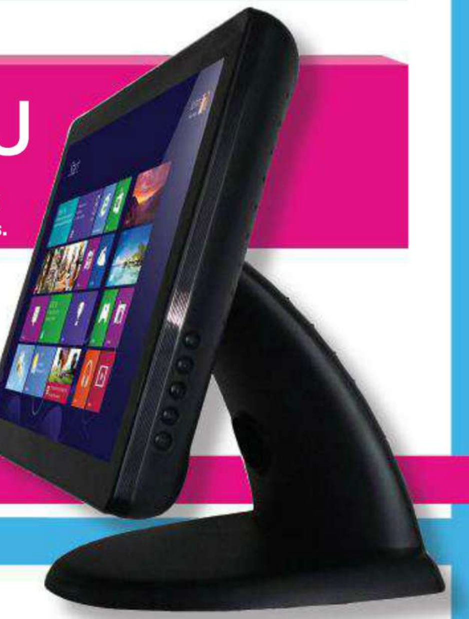
Acer T232HL

$500, www.acer.com

INNOVATOUCH IW2235P-U

Looks aren't everything

Despite the Kim Kardashian bottom, this panel performs.



WHEN WE began our hunt for flush-bezel touch panels to review, one of the few we could find was InnovaTouch's IW2235P-U. This IPS, 10-point projective-capacitive panel isn't the typical consumer-grade monitor—in fact, it's marketed for commercial applications; its price of $754 reflects that. That the panel is slightly smaller than the Acer, at just under 22-inches viewable, might immediately make you recoil and question the difference between this panel and consumer panels that cost about two-thirds the price.

After using the InnovaTouch side-by-side with the Acer, we can say there's a difference. Using Lagom's LCD test images on the pair of 1080p panels, we found the InnovaTouch slightly better than the Acer in image quality, particularly in areas of gradation. The Acer isn't horrible, but the InnovaTouch was far smoother. Grading the panel for digital photo work, we found the InnovaTouch slightly warmer and with a bit more contrast, too. Off axis, however, the InnovaTouch had a ghastly yellowish tinge to it.

One key advantage to the panel is in touch response. We used a painting app and drew our finger across the screen. When drawing at anything other than slow speeds, the Acer's digitizer lagged far behind the InnovaTouch's.

So what's not to like? The stand, which is designed to stabilize the panel when tilted flat, is insanely overbuilt—as well as downright ugly. There's also a pretty limited input selection—no media reader, camera, or USB ports; just DVI and VGA. So we suppose your choice really depends on what you value. The edge in image quality and touch performance goes to the InnovaTouch, but the Acer aces in price, ports, and style. **–GU**

VERDICT 8

InnovaTouch IW2235P-U

$754, www.touchsystems.com

LOGITECH WIRELESS RECHARGEABLE TOUCHPAD T650

Touch Windows 8 without a new monitor

WE WON'T LIE—Win8 isn't an optimal experience for traditional mouse and keyboard users. But what if you can't afford a touchscreen? Consider a giant touchpad. That's the idea behind Logitech's Wireless Rechargeable Touchpad T650. It's a giant (5-inch) touchpad that greatly aids the use of a touch-oriented operating system in the absence of a touchscreen.

The T650 supports up to four-finger gestures to help you navigate Metro, err, Modern. Various moves perform different commands in Win8, such as swiping four fingers to the left or right to "snap" a Window on the desktop. Four fingers up or down on the pad will minimize or maximize a window, while swiping three fingers up pulls up the Start screen. We're honestly not fans of any of the multitouch touchpad controls, as they're not uniform across devices and all the swiping and gesturing makes us feel like we're casting a magic missile more than controlling a cursor. Plus there's the tendency to inadvertently open a program.

The Touchpad's surface itself is glass and, frankly, smoother than the two touch panels we reviewed here. It recharges via Micro USB and works with Logitech's wonderful Unify system so you can run six Logitech Unify devices from a single 2.4GHz RF dongle. Using the Touchpad feels luxurious if you're coming off a cramped notebook touchpad but it can use some improvements. The Touchpad has a hard edge that we wished was beveled, as we kept catching our finger when we swiped in from the right to pull up the Charms bar.

While it's great for moving through the Modern interface quickly, we had problems with the Touchpad in precision work, such as selecting a word or one or two letters of a document for deletion or editing. With a mouse, it's second-nature to make such precision moves—not so with the Touchpad, which takes too much concentration. Another issue we had was selecting things to drag around the desktop with the Touchpad—it takes a wee bit too much finger pressure to accomplish. **–GU**

The T650 offers a luxuriously smooth, 5-inch touch surface to navigate Windows 8.

VERDICT 8

Logitech Wireless Rechargeable Touchpad T650

$80, www.logitech.com

LOGITECH T620

Years later, we still have issues with touch mice

LOGITECH'S T620 reminds us of other touch-enabled mice and—unfortunately—those aren't mice we were very fond of. Most of the surface of the T620 is touch-enabled. To left-click you can either push the whole body down or tap the left side of it. That's not it, though—no fewer than 10 different Windows 8 functions can be accessed by touching or stroking different parts of the mouse body. To pull up the Charms bar, for example, you can stroke your finger in from the right side. In theory, it sounds neat to be able to command the OS from the mouse but we found the surface much too cramped. If we had to have "touch," we'd rather pair Logitech's Touchpad T650 with a traditional mouse rather than just try to tough it out with the T620 alone. **–GU**

The Touch mouse T620 tries to jam too many features into its small touch surface.

VERDICT 6

Logitech T620

$70, www.logitech.com

LOGITECH T400

It's like the Start Menu never left

YOU DON'T KNOW how much something means to you until it's gone, and with Windows 8, we're really pining for the Start menu. Sniff. Logitech's T400 helps us get over that loss. With one touch on the glass touch area, the Modern UI Start screen is available. Like the T620 and T650, it uses Logitech's rather nifty Unify dongle that can drive up to six devices at once. Beside the easy access to the Start screen, you can also smoothly scroll on two different axes with the T400. We appreciate the limited command set rather than the surfeit of gestures on the T620. The only other thing we'd want is an option to directly access the Charms bar. Our one real complaint about the T400 is that it's way too small, which made driving the mouse uncomfortable rather quickly. **–GU**

We liked the well-defined touch area of the T400 but it's built for smaller hands.

VERDICT 7

Logitech T400

$50, www.logitech.com

MICROSOFT SCULPT COMFORT KEYBOARD

Curved Microsoft keyboard offers hotkeys for Windows 8

THE NEXT iteration in a long line of curved keyboards from Microsoft, the Sculpt Comfort Keyboard shares familiar lines with its predecessors. As ergonomic keyboards go, this one is rather flat, and the keys are contiguous from side to side. The palm rest is removable and also has feet enabling you to add height to the front of the keyboard.

Designed for use with Windows 8, the Sculpt Comfort Keyboard's function keys double as hotkeys used to emulate actions and gestures within Microsoft's new OS. The hotkey configuration is controlled using a switch above the number pad, making it difficult to switch back and forth between the two modes.

Microsoft's Sculpt Comfort Keyboard uses 2.4GHz wireless connectivity with the included USB dongle and is powered by two AAA batteries. –TF

Microsoft's latest curved keyboard features a split spacebar and wireless connectivity.

VERDICT 8

Microsoft Sculpt Comfort Keyboard

$60, www.microsoft.com

MICROSOFT WEDGE MOBILE KEYBOARD

Bluetooth keyboard geared toward mobile PC or tablet users

MICROSOFT'S WEDGE Mobile Keyboard provides an alternative input method for PC users on the go. A sturdy design paired with its diminutive size make it easy to carry in a bag or backpack. The included cover and tablet stand add significant weight to the keyboard. Bluetooth connectivity allows the Wedge Mobile Keyboard to be used with tablets or smartphones running a variety of platforms.

Provided along the top row of the keyboard are media playback controls and buttons to activate the Charms buttons found in Windows 8. The Wedge Mobile Keyboard's physical keys make touch typing much more feasible than screen-based input methods, but the key spacing leaves something to be desired.

The build quality of the Wedge Mobile Keyboard is second to none. We wish the same could be said about the typing experience. –TF

Mobile Keyboard really comes into its own when used with Windows 8.

VERDICT 7

Microsoft Wedge Mobile Keyboard

$80, www.microsoft.com

GETTING BY WITHOUT TOUCH

HOW TO NAVIGATE WINDOWS 8 WITH KEYBOARD SHORTCUTS

So you want to update to Windows 8 but have no intention of buying new touchy-feely hardware. Some common keyboard shortcuts will make getting around Windows 8 much easier than using just your mouse.

Windows key + start typing: Search
Windows key + C: Expose the Charms bar
Windows key + F: Open the Search charm to search files
Windows key + Q: Open the Search charm to search apps
Windows key + H: Open the Share charm
Windows key + I: Open the Settings charm (this is where you'll find the power button)
Windows key + K: Open the Devices charm
Windows key + Shift + period (.): Snap an app to the left
Windows key + period (.): Snap an app to the right
Windows key + J: Switch the main app and the snapped app
Windows key + Ctrl + Tab: Cycle through open apps (except desktop apps)
Windows key + D: Switch from Modern to Desktop mode
Windows key + X: Access a slew of Windows tools like Power Options, Device Manager, Control Panel, Run, etc.

Esc
Tab
Caps Lock
Shift
Ctrl
Alt
Q W E R T
A S D F
Z X C V

BY MARCO CHIAPPETTA

THE BEST OF BOTH WORLDS

LUCIDLOGIX VIRTU MAKES HYBRID GRAPHICS ON THE DESKTOP POSSIBLE

Historically, integrated graphics, with their notoriously lackluster performance, have been of little interest to power users. But perceptions began to change with Intel's Sandy Bridge, and later its Ivy Bridge, microarchitecture. While Sandy Bridge's DX10-class, Intel HD 2000/3000 graphics engines aren't cutting-edge by any means, they offer enough performance for many mainstream PC users, and consequently, helped Intel gain market share in the graphics race. Ivy Bridge further improves the situation with a more powerful graphics core outfitted with additional execution units and DX11 support. Whereas Intel's HD 3000 offers 12 EUs, Ivy Bridge's HD 4000 engine has 16.

But perhaps the most sought-after feature of Sandy Bridge and Ivy Bridge is Quick Sync. Quick Sync is a dedicated encoding/decoding engine that can burn through video-encoding tasks lightning-fast. Problem is, Quick Sync is part of the GPU block on Sandy Bridge and Ivy Bridge processors, and when a discrete GPU is installed and no monitor is connected to the integrated GPU, Quick Sync is unavailable.

Not being able to use Quick Sync and discrete graphics simultaneously didn't sit well with enthusiasts, but a workable solution was made available when LucidLogix introduced Virtu, a product that can virtualize the GPUs in systems and enabled hybrid graphics configurations. With Virtu, users can enjoy the benefits of a discrete GPU when gaming and still leverage an integrated GPU for power savings or Quick Sync. The best part is that Virtu is supported by a variety of motherboards. On the following pages we're going to explain how Virtu works and how you can set it up on your own system, and then we'll show you how a hybrid graphics configuration affected benchmark performance on our test systems.

LUCIDLOGIX VIRTU EXPLAINED

Although the underlying technology is relatively complex, it's somewhat easy to explain and understand how Virtu works. First and foremost, note that Virtu is a software solution from top to bottom—save for programming some BIOS code, no modifications are necessary at the hardware level. Virtu requires special hooks in the BIOS and the presence of both discrete (dGPU) and processor/integrated (iGPU) graphics in a system, but that's it.

When Virtu is installed on a system, it essentially virtualizes the available GPUs. The name Virtu is actually an abbreviation of GPU Virtualization. With Virtu, Lucid's Multi-GPU Abstraction Layer is installed between the OS and drivers, and that abstraction layer intercepts DirectX API calls from games or applications. At this point in time, OpenGL and WebGL are not supported. Once a call is intercepted, Virtu's Rendering Assignment Manager then analyzes it and decides to shuttle the subsequent task to either the iGPU or dGPU, based on a set of predetermined application profiles, which includes hundreds of games and multimedia tools.

Virtu can be configured in two modes: i-Mode or d-Mode. I-Mode refers to a configuration in which a monitor is connected to the integrated graphics engine's display output, while d-Mode means the monitor is connected to the discrete GPU. We mention the modes available because the final step Virtu performs is dependent on the mode being used. Once a task is complete, the output (typically a rendered frame) is copied to the appropriate GPU's frame buffer, where it is finally output to the screen. When operating in i-Mode, the dGPU's output is copied to the iGPU's frame buffer memory; vice versa for d-Mode.

Discrete Graphics
Integrated Graphics
BOTH

Currently there are three different versions of LucidLogix Virtu available to end users: Virtu Green, Virtu Universal, and Virtu MVP. All the different versions function in a similar manner, but each has a different feature set. Virtu Green is the most basic version and works only on Intel platforms. Next up the chain is Virtu Universal, which works with both Intel and AMD platforms and also adds support for Lucid's Virtual V-Sync technology. Finally, there is Virtu MVP, which has all the features and compatibility of Universal, but adds support for Lucid's HyperFormance technology, as well.

While they're independently configurable, Virtual V-Sync and HyperFormance are interconnected. These two features have been mistakenly characterized as game performance enhancers, when in fact they'll only affect image quality and input responsiveness. Virtual V-Sync leverages the iGPU's resources when the discrete GPU is being used to probe the dGPU's frame buffer and ensure that only the last fully rendered frame is shown on the screen. By doing so, Virtual V-Sync prevents tearing artifacts and always ensures the latest frame data is displayed on screen. It's only useful, however, when a game's frame rate exceeds the refresh rate of the attached monitor, which is usually 60Hz (or 60fps) for mainstream LCDs. HyperFormance uses a predictive algorithm to ascertain which frames will never be displayed, and removes any unnecessary rendering tasks for those frames from the pipeline, freeing up the dGPU to process only the items which will ultimately be displayed. This results in a decreased workload for the dGPU and an increase in responsiveness, but like Virtual V-Sync, HyperFormance is only useful when frame rates exceed the monitor's refresh rate.

VIRTU'S HARDWARE CONSIDERATIONS

Short of having a compatible motherboard, as well as discrete and integrated processor GPUs, there are no specific hardware considerations for Virtu. As we've mentioned, it's a software-only solution. LucidLogix has been working with motherboard manufacturers to have Virtu included with strategic motherboards—typically those supporting Intel's Sandy Bridge and Ivy Bridge-based processors—but Virtu is also compatible with AMD's A-Series APU chipsets. Due to Virtu's requirement for both discrete and integrated graphics processors, however, it does not support any high-end, enthusiast-class chipsets, like those designed for Intel's Sandy Bridge-E or AMD's Bulldozer, for example, as those processors lack on-die graphics.

At this point in time, Virtu is qualified to work with single discrete-GPU configurations and is also compatible with any display output—DVI, DisplayPort, HDMI, etc. are all supported. Virtu also supports multimonitor configurations, but multi-GPU support is iffy. We asked Lucid about Virtu's support for CrossFire or SLI multi-GPU configs and were told, "The reason for limited support today is our flexibility to plug the display in i-Mode (to motherboard) or d-Mode (discrete GPU). In i-Mode, which is the most popular one, we enable additional power savings and noise reduction, but the vendor control panels for SLI or CrossFire are not available. Also, the Virtu product line is shipped in mass volumes (expecting to pass 10 million units by end of year). Virtu is for the mass market. SLI/CF are relatively smaller markets and require a great deal of work with special workarounds." Indeed, when in i-Mode, Nvidia's and AMD's driver control panels will not load. In fact, if you try to access it when Virtu is enabled in i-Mode, an error message will pop up saying a supported GPU is not available, although the drivers for the GPU do load with Windows. The nonfunctioning control panels prevent users from switching on SLI or CrossFire, though, and prevent their application profiles from properly detecting games. With that said, you can start up a system in d-Mode, turn on SLI or CrossFire, then switch back to i-Mode, but success isn't guaranteed. We did get CrossFire working in i-Mode, but SLI never scaled properly.

THE COMPETING STANDARDS

Hybrid graphics are hardly new, and certainly not unique to Virtu. Nvidia and AMD both offer switchable graphics solutions to achieve many of the same goals as Virtu. Nvidia's Optimus technology seamlessly switches between discrete and integrated GPUs depending on an application's needs or available power. AMD's switchable graphics, while not quite as seamless as Nvidia's, essentially does the same thing. But both Nvidia's and AMD's technologies are typically relegated to the mobile space, save for a single Alienware system (the X51) that leverages Optimus.

We reached out to both companies to see if either had switchable graphics solutions in the works for desktop systems and got the typical answer that neither company could comment on unreleased products. Nvidia said there is nothing preventing OEMs from using Optimus on desktop systems, but that it hasn't been done because power is much less of a concern on desktop system, especially since recently released graphics cards consume little power while idling or sitting at the desktop. A rep for AMD said something similar: "On desktop platforms, AMD leads in power efficiency with ZeroCore Power. This vastly reduces power without having to rely on solutions such as switchable graphics."

The closest Nvidia has come to offering a hybrid graphics solution for desktops is with this wee Alienware X51 PC.

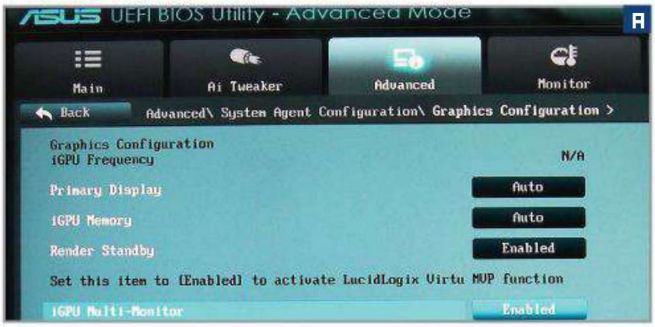
HOW TO SET UP VIRTU ON A DESKTOP PC

Installing Virtu on a system could not be any easier. Assuming you've got a compatible platform with the necessary motherboard and iGPU and dGPU installed, there are only a few steps necessary to get Virtu up and running.

1 CHOOSE YOUR MODE As we've mentioned, Virtu can be set up in i-Mode, in which a monitor is connected to the processor's integrated graphics output, or d-Mode, in which a monitor is connected to the discrete graphics card. Although our tests didn't show much difference in either mode, you'll want to use i-Mode if power consumption is your main concern and d-Mode if game performance is your priority. To choose your mode, simply connect your monitor to the desired display output on your graphics card (d-Mode) or motherboard (i-Mode).

2 ENABLE VIRTU IN THE SYSTEM BIOS/UEFI For Virtu to function, you must be using a compatible motherboard with the necessary hooks incorporated into its system BIOS/UEFI. If you're unsure about your motherboard's support for Virtu, reference its specification on the manufacturer's website (if Virtu was included on your motherboard's driver disc, chances are it's supported).

» If you're certain you've got a Virtu-compatible motherboard, the next step is to enter the system BIOS and enable Virtu **(image A)**. On the Asus motherboard we used for testing, the setting was located in the Advanced > System Agent Configuration > Graphics Configuration section of the BIOS. The name and location of the setting will vary from manufacturer to manufacturer, however.


A
ASUS UEFI BIOS Utility - Advanced Mode
Main
Ai Tweaker
Advanced
Monitor
Back

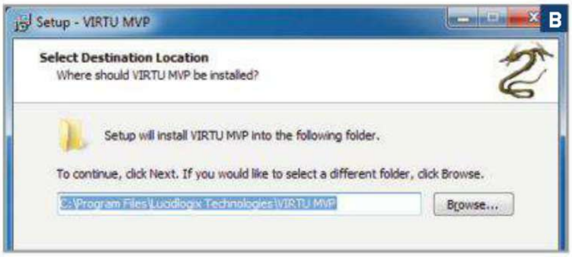
Advanced\ System Agent Configuration\ Graphics Configuration >

Graphics Configuration
iGPU Frequency N/A
Primary Display Auto
iGPU Memory Auto
Render Standby Enabled
Set this item to [Enabled] to activate LucidLogix Virtu MVP function
iGPU Multi-Monitor Enabled

3 INSTALL YOUR GPU DRIVERS Virtu requires that your GPU drivers be installed before Virtu. Once you've got your monitor(s) connected and the necessary feature enabled in the BIOS, boot into Windows and install the latest drivers for your iGPU and dGPU.

4 INSTALL VIRTU Installing Virtu requires no special knowledge or configuration information. The tool installs the necessary drivers and abstraction layers and automatically detects the hardware in the system. Although a Virtu installer was likely included on your motherboard's driver disc, we recommend grabbing the most recent version from the LucidLogix website to ensure the broadest compatibility.

» If you don't need to change the default installation options, simply start the installer, accept the license agreement, and click through the onscreen prompts to complete the process **(image B)**. If all went to plan, once rebooted, Virtu will be installed and enabled.


B
Setup - VIRTU MVP
Browse...

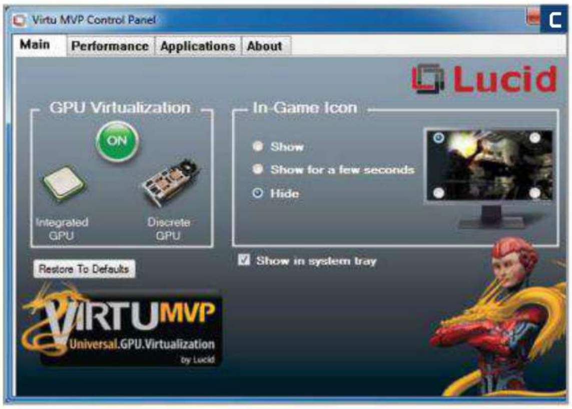
Select Destination Location
Where should VIRTU MVP be installed?

Setup will install VIRTU MVP into the following folder.

To continue, click Next. If you would like to select a different folder, click Browse.

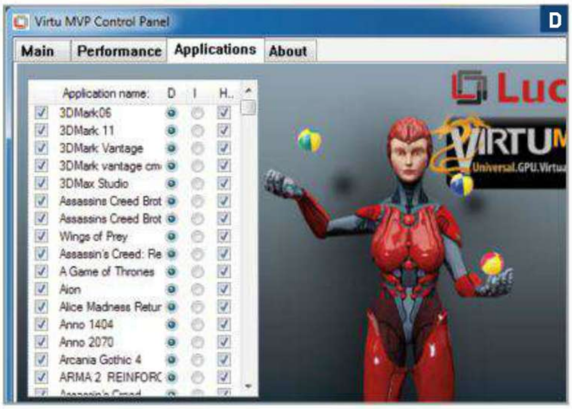
C:\Program Files\Lucidlogix Technologies\VIRTU MVP

5 USING VIRTU When the Virtu installation is complete, GPU virtualization will be enabled by default. To access Virtu's control panel, right-click the Virtu icon in the system tray and simply choose the option to open the control panel. There are only four tabs available in the Virtu tool—Main **(image C)**, Performance **(image D)**, Applications, and About—and they're all simple to navigate.


C
Virtu MVP Control Panel
Main
Performance
Applications
About
Lucid
GPU Virtualization
ON
Integrated GPU
Discrete GPU
In-Game Icon
Show
Show for a few seconds
Hide
Show in system tray
Restore To Defaults
VIRTU MVP
Universal.GPU.Virtualization
by Lucid

GPU Virtualization: ON

☑ Show in system tray


D
Virtu MVP Control Panel
Main
Performance
Applications
About
Luc
VIRTU
Universal.GPU.Virtu

	Application name:	D	I	H..
☑	3DMark06	●	○	☑
☑	3DMark 11	●	○	☑
☑	3DMark Vantage	●	○	☑
☑	3DMark vantage cm	●	○	☑
☑	3DMax Studio	●	○	☑
☑	Assassins Creed Brot	●	○	☑
☑	Assassins Creed Brot	●	○	☑
☑	Wings of Prey	●	○	☑
☑	Assassin's Creed: Re	●	○	☑
☑	A Game of Thrones	●	○	☑
☑	Aion	●	○	☑
☑	Alice Madness Retur	●	○	☑
☑	Anno 1404	●	○	☑
☑	Anno 2070	●	○	☑
☑	Arcania Gothic 4	●	○	☑
☑	ARMA 2 REINFORC	●	○	☑
☑	Assassin's Creed	●	○	☑

PUTTING VIRTU TO THE TEST

To get a feel for how Virtu functioned and to test whether or not it affects performance, we built up an Intel Ivy Bridge Core i7-3770-based system with integrated Intel HD 4000-series graphics, using a Z77 Express motherboard from Asus, 8GB of RAM, and a few high-end graphics cards from Nvidia and AMD, namely a pair of GeForce GTX 680s and a pair of Radeon HD 7970s. We tested every supported configuration, in both i-Mode and d-Mode, checking performance and power consumption along the way.

What we found was that Virtu had little impact on power consumption with our hardware. In fact, power consumption was typically a bit higher using Virtu, presumably because the iGPU is used for some of Virtu's proprietary functions when the dGPU in under load. We should point out, however, that this will not always be the case. Some older graphics cards behave differently under Virtu and may exhibit much lower idle power consumption. With the GeForce GTX 680 and Radeon HD 7970, though, idle power was mostly flat.

In terms of game performance, we found that Virtu had little impact. We saw some slight performance variations from configuration to configuration, but the deltas were relatively small and of no consequence. There is some overhead associated with shuttling frame buffer data between GPUs, but Lucid seems to have done a good job minimizing its impact on frame rates.

For the most part, Virtu just worked. When we wanted to use Quick Sync we could, regardless of the graphics configuration, and the applications and games we tested didn't exhibit any image-quality or performance issues. Quick Sync's output quality was also unchanged in each configuration. We did, however, experience an issue with Metro 2033 when in i-Mode. The game simply wouldn't launch when GPU Virtualization was enabled. We'd get to the loading screen and the game would just hang.

SPECIFICATIONS

POWER CONSUMPTION	**Intel HD 4000**	**GeForce GTX 680**	**GeForce GTX 680 (d-Mode)**	**GeForce GTX 680 (i-Mode)**	**Radeon HD 7970**	**Radeon HD 7970 (d-Mode)**	**Radeon HD 7970 (i-Mode)**
Idle (W)	89	112	114	115	115	111	113
Load (W)	116	308	312	316	319	322	323
GAME PERFORMANCE							
3DMark 11 (Extreme Preset)							
Overall Score	224	3,349	3,352	3,311	2,825	2,823	3,609
Graphics Score	197	3,062	3,064	3,029	2,565	2,564	3,310
Metro 2033 (High Quality, AAA, 16X Aniso)							
1920x1200 (fps)	10.67	89.33	88	Fail	81.33	82	Fail
2560x1600 (fps)	6.67	57	56.67	Fail	54.33	55.67	Fail
Alien vs. Predator (SSAO=On, 4x AA, 16x Aniso)							
1920x1200 (fps)	5.2	52.8	52.7	50.7	62.3	62.4	60.1
2560x1600 (fps)	5	32	32	30.8	38.2	38.3	34.7

MEDIA ENCODING PERFORMANCE	**CPU Only**	**AMD Stream**	**Nvidia CUDA**	**Quick Sync**	**Quick Sync w/ Virtu & 7970**	**Quick Sync w/ Virtu & GTX 680**
Cyberlink MediaEspresso 6.5 (sec)	0:31	0:40	0:25	0:07	0:07	0:07

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NEW RIG DONE RIGHT

ESSENTIAL FIRST STEPS FOR BREAKING-IN A FRESHLY BUILT PC

BY GORDON MAH UNG AND DAVID MURPHY

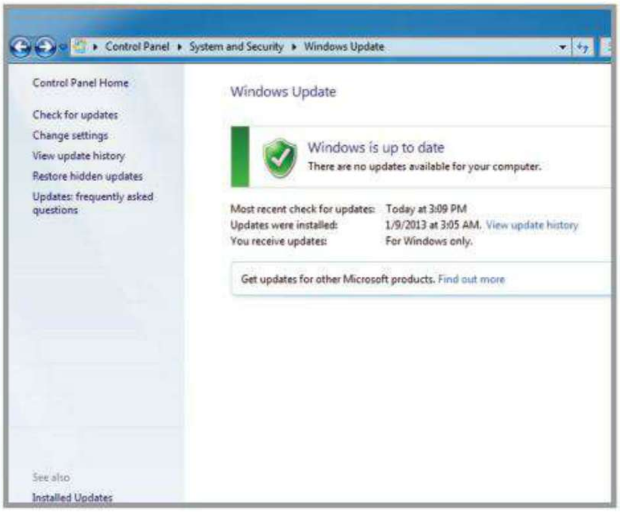
All expecting parents have read *What to Expect When You're Expecting*, because when that little bundle of joy drops out of mommy, you'd better be ready with lots of paper towels and a whole lot of specialized knowledge about what to do from that moment forward. Though it's not quite as messy (or scary), a new PC requires a similar sort of informed approach if you want to raise it properly from the moment hit the power button for the very first time. You'll be tempted to pick it up and coo, "Whose a widdle PC?," and then immediately benchmark the shinola out of it. We understand the impulse, and the excitement, but hold your horses, cowboy. You've got to take it slow with a new rig, and get it set up correctly the first time, or else all your future efforts will be for naught. That's where we come in.

In this handy guide, we'll show you what to do with your new PC in those first crucial out-of-the-box moments, and will hold your hand all the way from the first boot until the PC is ready to run its first benchmark. With our help, your bundle of bits will quickly grow from a fragile, schizophrenic rig to a fully up-to-date machine that's secure, tweaked for maximum performance, and ready to make daddy or mommy proud. Sniff—they boot up so fast!

WINDOWS UPDATE IT!

With your new PC connected to the Internet, the absolute first thing you should do is manually run Windows Update. Once it's done, run it again. Why? It's not because Windows 7 and Windows 8 are particularly soft targets, but as the world's dominant operating systems (well, Win7 anyway), they're basically the biggest targets around. With the dangers of infected Flash ads, JavaScript exploits, and an untold number of threats poised to attack unpatched machines, wading into the Internet with an unpatched box is about as wise as running buck naked and blindfolded into a cactus patch.

So before you step one foot onto the Internet, run Windows Update at least twice—some updates require the presence of a preceding update in order to be installed. Then you can run out to procure the other much-needed utilities and tools for your new PC. On Windows 8 machines, go to the Modern UI and start to type **update**. On Windows 7, go to Start and search for **update**.



Control Panel Home
Check for updates
Change settings
View update history
Restore hidden updates
Updates: frequently asked questions

Windows Update

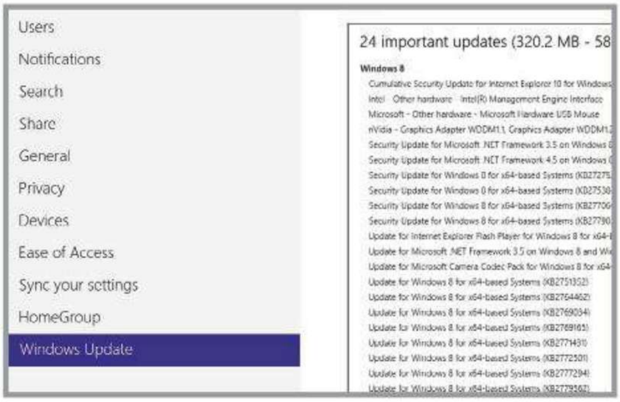
Windows is up to date
There are no updates available for your computer.

Most recent check for updates: Today at 3:09 PM
Updates were installed: 1/9/2013 at 3:05 AM. View update history
You receive updates: For Windows only.

Get updates for other Microsoft products. Find out more

See also
Installed Updates

That big green checkmark is exactly what you want to see when you navigate to the Windows Update control panel.



24 important updates (320.2 MB - 58

Windows 8

Cumulative Security Update for Internet Explorer 10 for Windows
Intel - Other hardware - Intel(R) Management Engine Interface
Microsoft - Other hardware - Microsoft Hardware USB Mouse
nVidia - Graphics Adapter WDDM1.1, Graphics Adapter WDDM1.
Security Update for Microsoft .NET Framework 3.5 on Windows
Security Update for Microsoft .NET Framework 4.5 on Windows
Security Update for Windows 8 for x64-based Systems (KB2727
Security Update for Windows 8 for x64-based Systems (KB2753
Security Update for Windows 8 for x64-based Systems (KB2770
Security Update for Windows 8 for x64-based Systems (KB2779
Update for Internet Explorer Flash Player for Windows 8 for x64-
Update for Microsoft .NET Framework 3.5 on Windows 8 and Wi
Update for Microsoft Camera Codec Pack for Windows 8 for x64-
Update for Windows 8 for x64-based Systems (KB2751352)
Update for Windows 8 for x64-based Systems (KB2764462)
Update for Windows 8 for x64-based Systems (KB2769034)
Update for Windows 8 for x64-based Systems (KB2769165)
Update for Windows 8 for x64-based Systems (KB2771431)
Update for Windows 8 for x64-based Systems (KB2772501)
Update for Windows 8 for x64-based Systems (KB2777294)
Update for Windows 8 for x64-based Systems (KB2779562)

Once your networking is up, run Windows Update immediately.

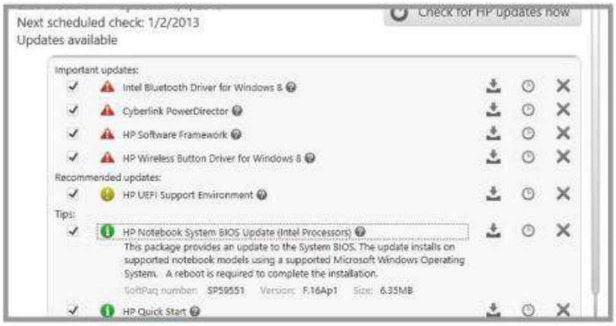
IF IT'S BROKEN, FIX IT

Former *Maximum PC* columnist Alex "The Saint" St. John said it best: "Drivers, she is always a-broken." OK, we added the Mario Brothers' sentence structure and accent for style, but he was right on. Drivers are usually a work in progress and they are often the cause of system wonkiness, even on brand-spanking-new machines. In fact, new machines are often the ones most in need of updated drivers, given their state-of-the-art hardware. Case in point, we unboxed a brand-spanking-new Windows 8 notebook for some testing and immediately had to update no fewer than four drivers.

Many "tier 1" OEMs provide their own driver update applications that will hunt down the latest drivers for their machines. On a recent HP Win8 laptop, for example, rather than having to chase down individual drivers, the HP update app did the work for us. This can work against you on occasion, though, as big companies often don't want headaches, so once a driver reaches a certain level of stability, they don't push new updates unless absolutely needed, even if the new driver may add improved features or performance. Then, a manual search will produce more satisfying results.

If you don't want to hunt for every single device driver by hand, there are alternatives, such as Slimware's SlimDrivers Free (www.slimwareutilities.com). This utility uses "crowdsourcing" to do what the large OEMs do with their driver updaters. Running SlimDrivers Free on another big OEM laptop, for example, yielded 14 updated drivers, while the OEM's update tool said nothing new was available.

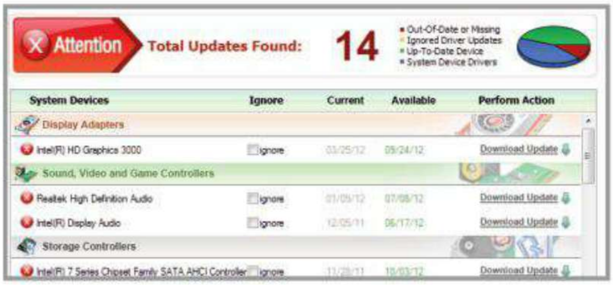
Which drivers do we typically recommend that you update on a new box? The most obvious are GPU drivers. Next up would be chipset drivers. We will add that results of driver updates will vary depending on your OS. Windows 7 is quite mature and drivers at this point are unlikely to add much beyond bug fixes. Windows 8, though, is constantly changing, so GPU, chipset, audio, USB, network—basically everything—should be checked for new drivers and generally installed.



Next scheduled check: 1/2/2013
Updates available

Important updates:
✓ Intel Bluetooth Driver for Windows 8
✓ Cyberlink PowerDirector
✓ HP Software Framework
✓ HP Wireless Button Driver for Windows 8
Recommended updates:
✓ HP UEFI Support Environment
Tips:
✓ HP Notebook System BIOS Update (Intel Processors)
This package provides an update to the System BIOS. The update installs on supported notebook models using a supported Microsoft Windows Operating System. A reboot is required to complete the installation.
SoftPaq number: SP59551 Version: F.16Ap1 Size: 6.35MB
✓ HP Quick Start

Take advantage of integrated driver-update tools on your PC.



Total Updates Found: 14

System Devices	Ignore	Current	Available	Perform Action
Display Adapters				
Intel(R) HD Graphics 3000	☐ Ignore	03/25/12	05/24/12	Download Update
Sound, Video and Game Controllers				
Realtek High Definition Audio	☐ Ignore	01/09/12	07/08/12	Download Update
Intel(R) Display Audio	☐ Ignore	12/05/11	06/17/12	Download Update
Storage Controllers				
Intel(R) 7 Series Chipset Family SATA AHCI Controller	☐ Ignore	11/28/11	10/03/12	Download Update

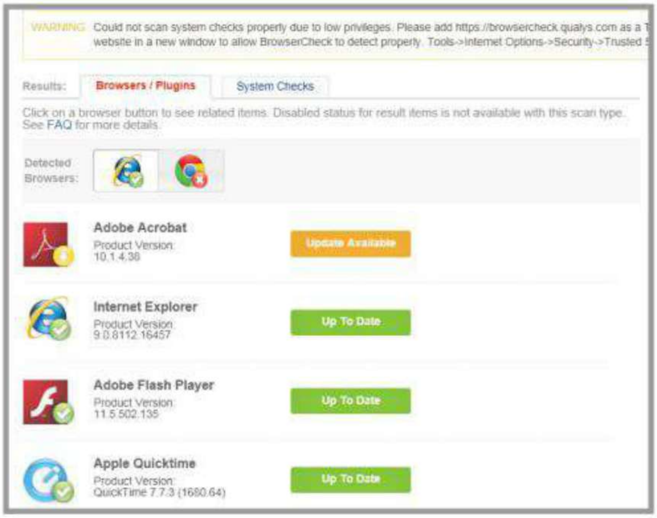
Slimware's SlimDriver Free hunts down new drivers for you.

SECURE IT

Your work is just getting started after you've installed an AV product. The old-school scan-your-drive-for-an-infected-file model has long been worthless. These days, malware often is installed in a nanosecond, using zero-day infections via broken browser plugins and scripting exploits. As much work as Microsoft has done to enhance security in Windows 15 (7 + 8), that doesn't help if you have an unpatched version of QuickTime, VLC, or Adobe Reader.

First, may we recommend that you consider paying for a good AV product such as F-Secure, Kaspersky, Norton, or BitDefender, among others? These products are highly rated for their ability to intercept zero-day attacks, and with rebates you can get enough keys to cover all your devices for a few dollars a year. If you're too cheap, consider using AVG Free, which is better at stopping zero-day attacks than Microsoft's Security Essentials product. MSE is the least bothersome, but it's lost a lot of luster of late.

With a proper AV app in place, you now need to be wary of your browser plugins. We recommend weekly checks of your browser using Qualys BrowserCheck (browsercheck.qualys.com). This free web tool will check your browser's plugins to see if they're the latest available. The intermediate and advanced options offer checks of all browsers as well as Windows Updates, too. Keeping your applications updated is also a key to avoiding infections. For that, we turn to Secunia PSI or the web-based OSI (www.secunia.com). Secunia's tools will check your installed apps and inform you if there are any risks, and either automatically download them or offer you a download link.


WARNING Could not scan system checks properly due to low privileges. Please add https://browsercheck.qualys.com as a website in a new window to allow BrowserCheck to detect properly. Tools->Internet Options->Security->Trusted

Click on a browser button to see related items. Disabled status for result items is not available with this scan type. See FAQ for more details.

Adobe Acrobat
Product Version: 10.1.4.38

Internet Explorer
Product Version: 9.0.8112.16457

Adobe Flash Player
Product Version: 11.5.502.135

Apple Quicktime
Product Version: QuickTime 7.7.3 (1680.64)

Staying on top of the state of your browser plugins is key to a good security regimen.

Running two AV apps is not recommended, but keeping one around for a second opinion isn't a bad idea. We often keep Malwarebytes installed just in case we need it. You should also consider installing VirusTotal Uploader (www.virustotal.com). This lets you right-mouse-click a file to have it sent to VirusTotal where it will be analyzed by more than 40 virus engines. Even more trick, if you suspect a process is mal, you can use the VirusTotal Uploader to send the executable that is running the process to be analyzed.

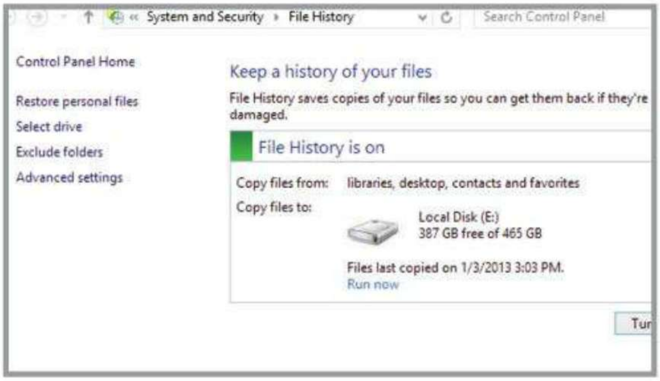
This is only the tip of the iceberg. Just remember security guru Bruce Schneier's words: "Security is not a product; it's a process."

HAVE A BACKUP PLAN OR TWO

The system-restore discs you created earlier will get you back in business should you experience a total meltdown, but you should also strongly consider setting up a backup plan now, not a day after your drive has died and you've lost all your data. For those times, we've found Window 7's Backup and Restore to work amazingly well. You'll need a second drive on the machine for the backups; we highly recommend that its capacity is equal to or larger than that of your primary drive. Remember to heed the warning that one is none and two is one.

With a USB optical drive plugged in or a second HDD in place, use Backup and Restore to create a system image, and then burn a boot disc that you will need should your drive fail. Now, also set up a file backup from your primary drive to your secondary drive and set it for a schedule that you're comfortable with. In the event of a primary drive failure, just replace the drive, boot to the restore disc you created, and point it at your backup images and files. When completed, you should be back in action with access to the files you had just before the failure.

Windows 8 users can set up the same file and image backup system from Windows 7, but it's called Windows 7 File Recovery. Just pull up search and start typing **file recovery** and look under Settings to access the same utility. Win8 actually has different options: File History will create backups on a file every hour, whereas Windows 7 File Recovery will run only once a day. What's better? Since our time and data is invaluable, we do both. File History is the Omega 13 of backup that lets you, say, go back to a file version from three hours before. Refresh is a great feature that "resets" the OS but it won't help if the drive has died. In that case, having a disc image and Windows 7 File Recovery backup set lets you drop in a new drive and be back up and running in a couple of hours, rather than the usual 12 hours of manually installing apps and recovering settings.


Keep a history of your files

File History saves copies of your files so you can get them back if they're damaged.

File History is on

Copy files from: libraries, desktop, contacts and favorites

Copy files to: Local Disk (E:) 387 GB free of 465 GB

Files last copied on 1/3/2013 3:03 PM.

Not to be confused with the Windows 7 File Recovery, Win8's File History makes hourly backups of your document files.

TRANSFER YOUR DATA

Best practices for moving files from your old PC to a new one

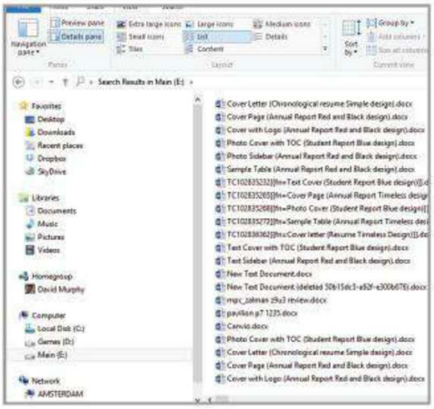
Once your system is set up how you like it, it's time to fill your fresh drive(s) with all your documents, music, and games. Follow these instructions for getting those various files situated in their new digs.

HOW TO TRANSFER... DOCUMENTS!

So, you have your new Windows 8 PC all ready to go. The problem? All of your important documents are stuck on your older system.

Assuming that you've been making ample use of Windows' My Documents folder to store just that, then transferring your files over is as easy as copying your entire C:\Users\[your name]\My Documents folder to a flash drive (or USB-based hard drive, depending on how much you'll be transferring). Connect the key or drive to your new system and copy the files over—it couldn't be easier.

If you're a bit messier, however, and have documents strewn all around your hard drive, then you'll probably want to make use of Windows' built-in search tool to find your documents. Assuming you're on Windows Vista or later, you just have to pull up Windows Explorer, highlight your Computer in the left-hand sidebar, and type ***.doc*** in the upper-right-hand search box—assuming, of course, that we're talking about .doc or .docx files. Sort the search results by Type to ensure you're looking at just your documents, and then highlight and copy them over to your external storage in the same way you'd transfer any file.



Cover Letter (Chronological resume Simple design).docx
Cover Page (Annual Report Red and Black design).docx
Cover with Logo (Annual Report Red and Black design).docx
Photo Cover with TOC (Student Report Blue design).docx
Photo Sidebar (Annual Report Red and Black design).docx
Sample Table (Annual Report Red and Black design).docx
Text Cover with TOC (Student Report Blue design).docx
Text Sidebar (Annual Report Red and Black design).docx
New Text Document.docx
pavilion p7 1235.docx
Canvio.docx
Photo Cover with TOC (Student Report Blue design).docx
Cover Letter (Chronological resume Simple design).docx
Cover Page (Annual Report Red and Black design).docx
Cover with Logo (Annual Report Red and Black design).docx

Lesson learned: Keeping all of your documents in one place makes it much easier to transfer them over to a new desktop or laptop at some point in the future.

You also might want to investigate the free app TeraCopy (download.cnet.com) if you're likely to be copying a ton of small files over to your external storage for transfer. While the third-party file-transfer app has proven to be a bit slower than Windows' built-in transfer tool for big files, it's a star for smaller files. Additionally, it also gives you the ability to pause your transfers (similar to Windows 8's file-copy tool), skip transfers that you've queued up, and have your computer automatically shut down once the transfer has finished.

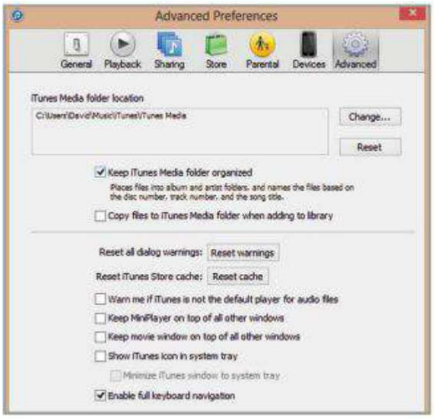
HOW TO TRANSFER... iTUNES!

We'll pause for a moment while your fellow *Maximum PC* readers look at you with suspicion, you iTunes fan you. Now that that's over with, we'll show you how to move your iTunes library to your new Windows 8 PC.

First off, you'll want to find your iTunes Library. To note: We're assuming you're using iTunes itself to organize your music, as any tunes you drag into iTunes' interface are automatically copied and placed into a specific location by the program. If not, you're on your own to hunt down where on your computer you've stashed your MP3 files. (Try using the same process we just described for Documents to get all of your MP3s onto a single piece of external storage.)

Pull up iTunes' Preferences windows and click its Advanced icon. iTunes will tell you exactly where it's keeping its Media folder. Navigate to this location within Windows Explorer and copy all the directories representing your music to some kind of external storage device.

Before you go dumping these tunes onto your new Windows 8 PC, download and install iTunes, and then head back to the same Preferences > Advanced window we just mentioned. Make sure the location you want iTunes to use for your new Media folder is set, and check the following two options: "Keep iTunes Media folder organized," and "Copy files to iTunes Media folder when adding to library." From there, all you have to do is drag-and-drop the folders full of music on your external drive directly into your new, empty iTunes folder on your Windows 8 PC—the app will take care of the rest.



iTunes Media folder location
C:\Users\David\Music\iTunes\iTunes Media

☑ Keep iTunes Media folder organized
Places files into album and artist folders, and names the files based on the disc number, track number, and the song title.
☐ Copy files to iTunes Media folder when adding to library

Reset all dialog warnings:
Reset iTunes Store cache:
☐ Warn me if iTunes is not the default player for audio files
☐ Keep MiniPlayer on top of all other windows
☐ Keep movie window on top of all other windows
☐ Show iTunes icon in system tray
☐ Minimize iTunes window to system tray
☑ Enable full keyboard navigation

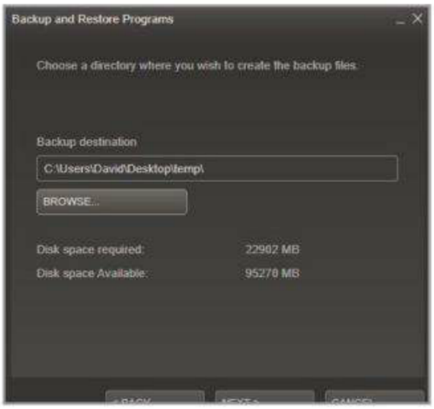
iTunes' ability to automatically organize your music library folder is an invaluable tool when it comes to moving your music around. In other words: Don't just copy your music in File Explorer!

HOW TO TRANSFER... STEAM!

Do your poor router a favor—don't just redownload all of your games onto your new PC. You don't have to, thanks to Valve's built-in backup feature within Steam.

Click the Steam menu in the upper-left corner of the app and select "Backup and Restore Games." Since you'll be moving all of your downloaded games from your old PC to your new one, make sure that "Backup currently installed programs" is selected in the window that appears and click Next. After that, select your games and click Next.

You can directly create this backup on your external media, but it might go a little faster to just find a temporary location on your hard drive (assuming you have the space) for now, and then copy over the


Backup and Restore Programs

Choose a directory where you wish to create the backup files.

Backup destination

C:\Users\David\Desktop\temp\

Disk space required: 22902 MB

Disk space Available: 95270 MB

In the olden days, there was no way to just transfer Steam games via the app itself—you had to re-download everything you wanted to play (after walking miles in the snow to do so).

Steam backup to external media after the fact. Click Next and you'll be given the option to assign your backup a name and file size—in other words, the size of the (possibly many) archives that Steam will create, if you're going to try to burn these to discs instead of just copying them en masse to removable storage. Click Next and go find your favorite movie to watch—this might take a while.

Once Steam's Backup and Restore program finishes, you can copy these files to an external drive and use the same process—but selecting Restore this time—to transfer these games over to your new system.

HOW TO TRANSFER... GAMES!

There's really only one tool that we trust when it comes to scanning our systems for our games' many different save files: the freeware app Gamesave Manager (www.gamesave-manager.com). Using this one is simple—heck, you don't even have to install it. Download the app and fire it up, and make sure you've updated its database to the most recent version (this is how the app figures out where your save files are).

From there, click the "Make a backup" link on the app's main screen. Select the games whose saves you want to back up, and then click the icon in the upper-right corner that looks like a file "wooshing" to the right (it's next to the big "X" icon). Pick a location for your backup file and let 'er rip—we recommend placing the saves on some external storage device.

Once you've finished reinstalling (or Steam transferring) your games to your new system, use Gamesave Manager to restore your saves by clicking the Open Archive(s) option on the app's main screen. Hunt down the files you previously created with Gamesave Manager (on the external storage device, we hope), and use that same oddly shaped file icon to restore your precious game progress.

CONNECTION SPEEDS COMPARED

What's the best way to transfer your files from one PC to another? Easy: drag-and-drop. OK, there's a bit more to it than that.

Researching all the theoretical maximum speeds of various connection types is easy. Trying to gauge just how they'll perform in a real-world environment is a bit trickier, given the multitude of factors that go into getting your files from Point A to Point B. And by factors, we really mean "bottlenecks."

It's time you accepted the honest truth: Your file transfer speeds will never be as fast as your research suggests. Your USB 3.0 connections aren't going to blaze by at 640MB/s (or soon, 1,280MB/s, once the connection standard is bumped up to 10Gb/s), nor will your Gigabit network cough up 125MB/s each and every time you go to copy a file over to your network storage device.

So just how do some of the more popular connections for file transferring stack up in a typical, real-world scenario? Spoiler: Not exactly as you might think.

A SATA 3 (6Gb/s) connection won big on our read and write tests of a single 6.01GB file (copied between a Samsung 830 Series SSD, our system's boot drive, and an OCZ Agility 3 SSD). In second place, however, was the Gigabit Ethernet transfer of that same file between our desktop PC and an Iomega StorCenter PX2-300d-2 NAS box (onto its RAID 0 array of two 2TB Hitachi Ultrastar drives).

Why didn't our USB 3.0 file transfer between our desktop's SSD and a USB 3.0–friendly Corsair Flash Voyager drive—with a theoretical connection speed much faster than that of Gigabit networking—win out by a landslide? A few thoughts on that: Our Gigabyte GA-Z68X-UD3H-B3's USB 3.0 controller or associated driver might not be up to snuff, but it's more likely that our flash drive itself is the performance bottleneck. Based on reports of other users' experience with this flash drive, the approximately 40MB/s transfer speed that we were topping out at seems reasonable.

And, to note, it took quite a bit longer to write our test file to our flash key via USB 3.0 than it did to read off it. A similar discrepancy appeared when copying the file between our two SSDs, a clear example of the differences between read and write performance across your file transfers. In other words, you can't necessarily freak out because files heading in one direction appear to be going slower than you might expect; try it the other way, too.

Our test transfer across USB 2.0 was the tortoise in our transfer race, and we look forward to the day when this legacy connection standard is finally put out to pasture.

So, what's there to learn from our crude look at file transfer performance? It's not the connection you have to be as concerned about as it is the devices involved in the transfer. The storage—flash or mechanical—that you're using on both sides of the transfer plays a big role in the performance you'll experience when you go to copy files. SATA 6Gb/s and USB 3.0 are plenty speedy, but only when both sides of the transfer play along.

INTERFACE COMPARISON

SATA 6Gb/s	SATA 6.0 Gb/s	USB 2.0	USB 2.0	USB 3.0	USB 3.0	Gigabit	Gigabit
Samsung 830 Series SSD to OCZ Agility 3 SSD	OCZ Agility 3 SSD to Samsung 830 Series SSD	Samsung 830 Series SSD to Corsair Flash Voyager	Corsair Flash Voyager to Samsung 830 Series SSD	Samsung 830 Series SSD to Corsair Flash Voyager	Corsair Flash Voyager to Samsung 830 Series SSD	Samsung 830 Series SSD to Iomega StorCenter PX2-300d-2 NAS box	Iomega StorCenter PX2-300d-2 NAS box to Samsung 830 Series SSD
27 seconds	29 seconds	207 seconds	182 seconds	156 seconds	77 seconds	94 seconds	61 seconds

Chart shows time it took to transfer a 6,154.24MB file between the respective two devices.

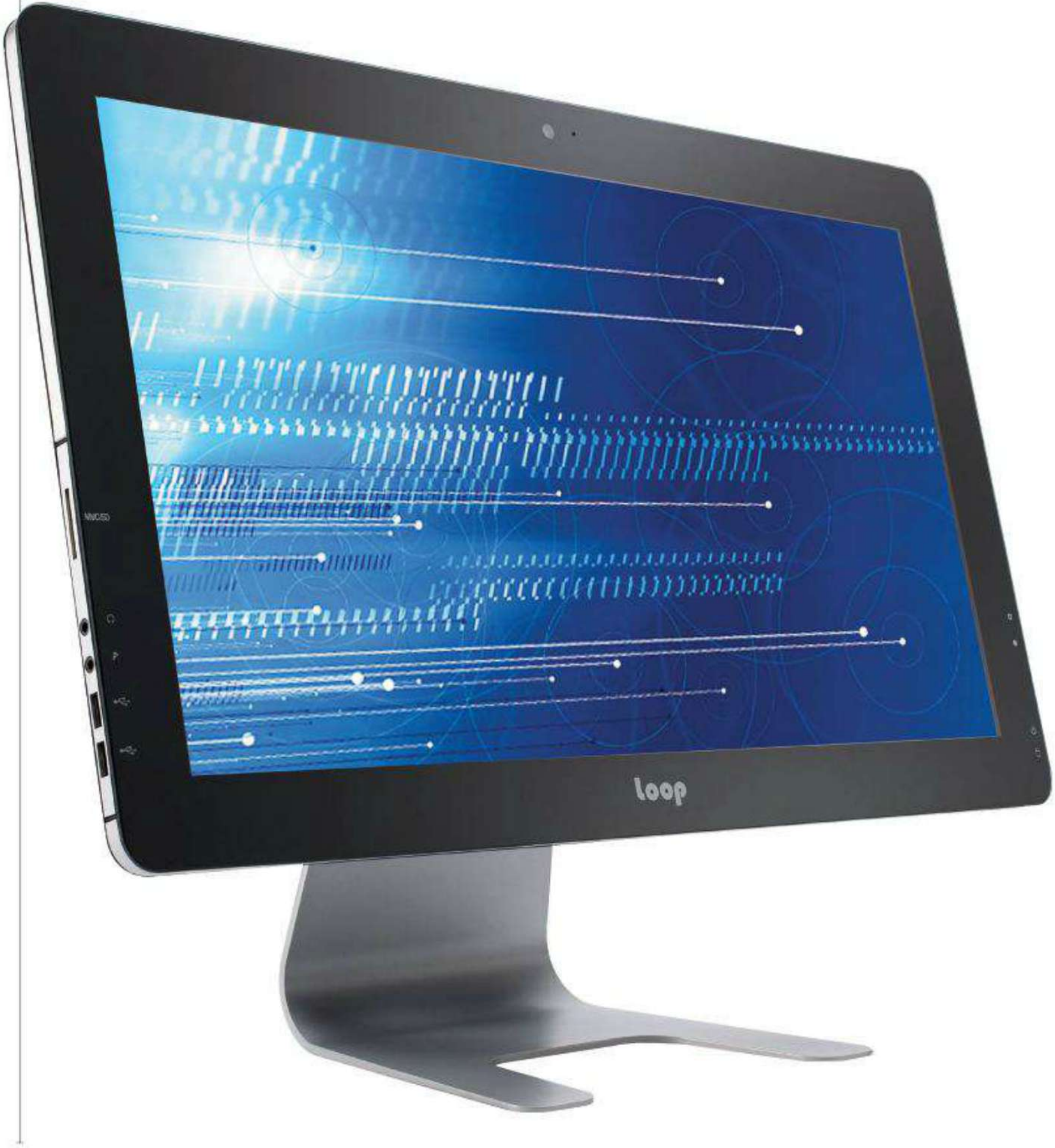
BUILD IT

GORDON MAH UNG **DEPUTY EDITOR**

Who Says You Can't Build an All-in-One?

This month we tackle a DIY AiO

LENGTH OF TIME: **1.5 HOURS** | LEVEL OF DIFFICULTY: **INTERMEDIATE TO ADVANCED**



THE MISSION The all-in-one PC is predicted to be one of the hottest PC form factors over the next few years. That's great for Joe 12-Pack, but for an enthusiast, an AiO is pretty much as monolithic as you can get. Sure, you might be able to add RAM or swap the HDD, but that's usually the extent of the average AiO's upgradeability.

Enter Intel's new push for the DIY AiO, the first serious attempt at building a standard around this practice. All-in-one bare-bones kits have likely been available before, but Intel's backing formalizes it as a real DIY category. The big change is the Thin Mini-ITX, which specifies far slimmer mobo profiles than regular Mini ITX, as well as fixing a spot where the CPU can be installed. The fixed CPU location enables standard heat pipe–type cooling solutions as an option, whereas Mini ITX allowed vendors to put the CPU anywhere on the board.

To get our feet wet, we decided to build a nicely outfitted AiO to see how it would compare spec-wise to a prebuilt peer. The result? You'll have to read to the end, but we'll be a clock tease and say that a DIY AiO might be just the way to go.

CHOOSING THE HARDWARE

THE FIRST STEP of building an AiO is finding the chassis. Since Intel has been the main driver behind a standard, a good place to start is at http://intel.ly/T1TZPa. The DIY site has numerous resources for builders. We recommend that you start with the Design Component Catalog (http://intel.ly/UxUKPT) as well as the Compatibility Matrix (http://intel.ly/VzcHfv). Remember, the standard is evolving and we're not at the point of desktops, where 98 percent of hardware is compatible. For example, some of the AiO models use proprietary coolers while others can use the standard Intel part. AiO units that don't use the standard Intel heat pipe should ship with their own. Also keep in mind the thermal constraints of an AiO before you buy the parts.

Our build started with a Loop L5 LP-2150 chassis. The chassis features a 21.5-inch panel and normally comes without the cooler and power brick for about $265. We did find some sites offering it packaged with the Intel cooler and a power brick though, for a small savings. The board we used is an Intel DH61AG. It supports an external power brick–type connector and up to a 65-watt TDP desktop processor. For our build, we tapped the quad-core 3.1GHz Core i5-3570S chip, which is nearly the same as the Core i7-3770S save for the Hyper-Threading. For storage, the board supports Mini PCIe SSDs and standard 2.5-inch drives. For our build, we opted for an Intel 240GB 335 Series SSD. Finally, we went with a pair of Patriot 4GB SO-DIMMs.

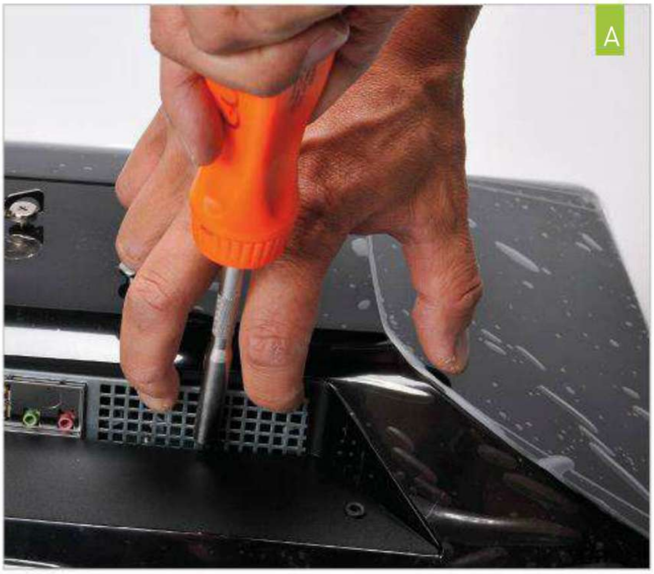
INGREDIENTS

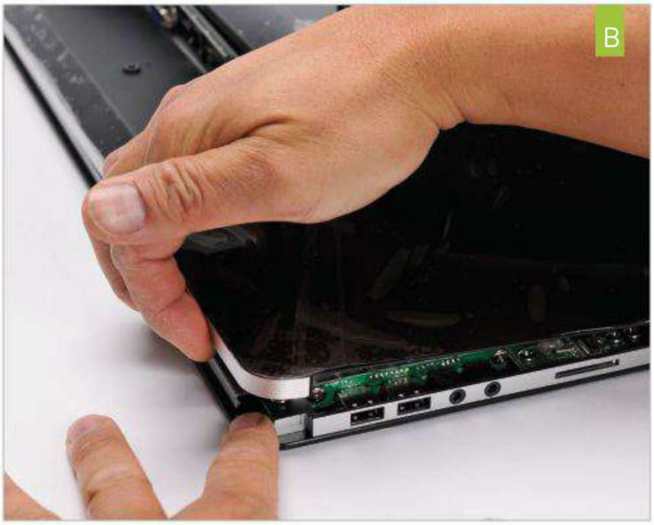
	PART	URL	PRICE
Chassis	Loop L5 LP-2150	www.loopint.com	**$265**
CPU	Core i5-3570S	www.intel.com	**$205**
RAM	8GB Patriot DDR3/1333	www.patriotmemory.com	**$38**
Motherboard	Intel DH61AG	www.intel.com	**$120**
Cooler	Intel HTS1155LP	www.intel.com	**$27**
PSU	FSP 150-ABAN1	www.fspgroupusa.com	**$48**
Wi-Fi	Intel 62230AN. HMWG Wi-Fi card	www.intel.com	**$24**
SSD	Intel 240GB 335 SSD	www.intel.com	**$200**
ODD	LG 12.7m GT60N 8x DVD+R combo drive	www.lg.com	**$28**
OS	Windows 7 Home Premium 64-bit	www.microsoft.com	**$99**
Total			**$1,054**

1

PREPARE THE CHASSIS

TO OPEN THE LOOP L5, lay it facedown on a clean, non-scratch surface and remove the five screws on back. Now, with the opening for the I/O shield facing you, gently push the tip of your screwdriver on the metal next to the exhaust vent while carefully pulling up on the chassis with your fingers (image A) until the back pops off just a bit. Then, carefully pry off the back, starting at the USB ports and headphone ports (image B). You'll use this same process to access the guts of the AiO for future upgrades.





2

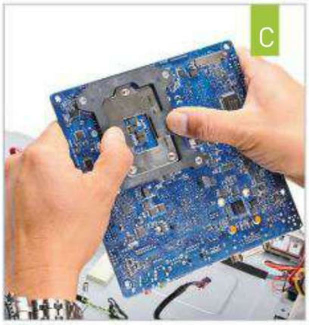
INSTALL DRIVES, CPU, AND RAM

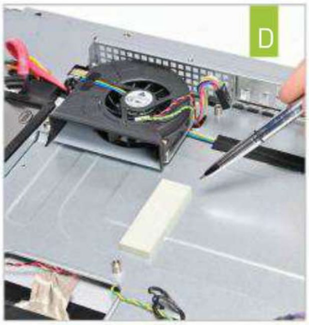
WE'LL SKIP THE usual illustration of mounting the optical drive and SSD/HDD in the caddies and screwing them down, as the process is well known to most *Maximum PC* readers, but you can go ahead and do this now. (For new builders, Intel provides thorough video instructions for building a system in the Loop at http://intel.ly/TPWoyQ). Likewise, you've seen us install RAM and the CPU dozens of times; now is a good time to do that, as well. With the board out, you should also slot the Wi-Fi card into the Mini PCIe slot nearest the PCIe slot. Then, install the I/O shield.

3

INSTALL THE BACKPLATE

TO USE THE STOCK Intel thermal cooler, you'll need to install the backplate that comes with the kit. It sticks on with an adhesive pad (**image C**). The chassis should also have come with a thick thermal pad that gets mounted to the back of the motherboard, under the voltage regulation modules, or, if you can aim properly, to the chassis itself (**image D**). It mounts using an adhesive, so choose wisely. Now, mount the motherboard and screw it in place. As always, pay special attention to how the openings in the I/O shield line up with the motherboard before you screw it down (i.e., make sure the metal fingers coming off the I/O shield don't jam into the ports.)

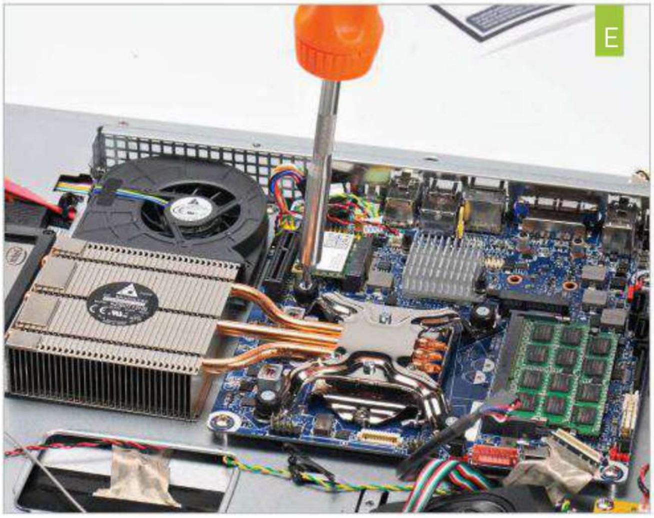

C


D

4

INSTALL THE COOLER

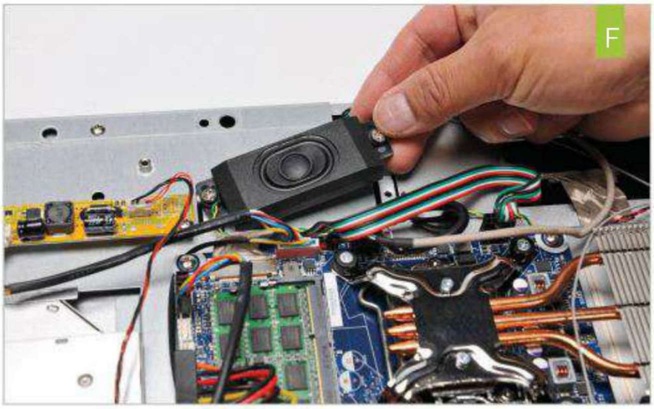
WITH THE MOTHERBOARD in place, it's time to screw the cooler in place. The cooler should have an Intel thermal pad in place. If yours doesn't, or you are mounting it for a second time, add a small bit of thermal paste to the CPU and spread it out with a plastic bag across the surface of the heat spreader. Use the four screws to mount the cooler to the backplate (**image E**), and also screw down the two screws at the end of the heat pipe.


E

5

PUSH ASIDE THE SPEAKER

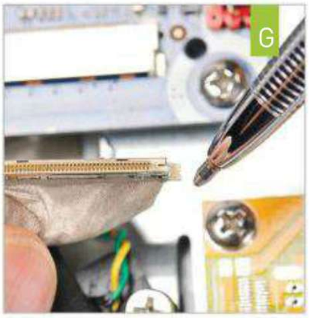
IT'S PRETTY tight in the AiO, so for removing or installing cables, you'll have to remove or simply move the speaker on the left side of the machine. Just undo one screw and move the speaker out of the way (**image F**).

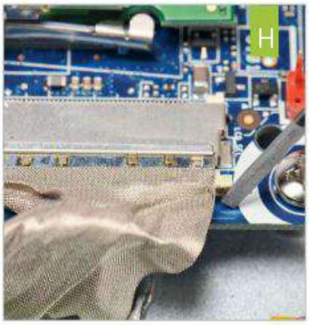

F

6

PLUG IN THE PANEL

THE PANEL uses a delicate internal LVDS connector. While at first glance it appears to go in either way, the connector is keyed (**image G**). Carefully insert the cable into the LVDS port and then use a small object, such as a flat-head screwdriver, to carefully push it into place by alternatively nudging on each side of the connector while holding one side with your finger (**image H**). Once it's in place, don't ever remove the LVDS connector by tugging on the ribbon cable. If you have to remove it, use a small flat-head screwdriver to slowly nudge it out from the sides.

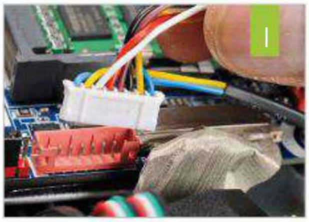

G

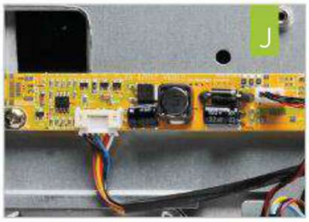

H

7

PLUG IN THE INVERTER

UNLIKE A DESKTOP monitor, which is powered by its own power brick or internal AC/DC device, the AiO needs to be powered from the motherboard. To do that you need to plug the 7-pin connector into the red header next to the LVDS connector (**image I**). This is also keyed to only fit in one way and should snap into place. Once that's done, follow the cable out to the end where you should find another connector. This gets plugged into the inverter board, which is the small orange, rectangular PCB to the left of the speaker (**image J**).

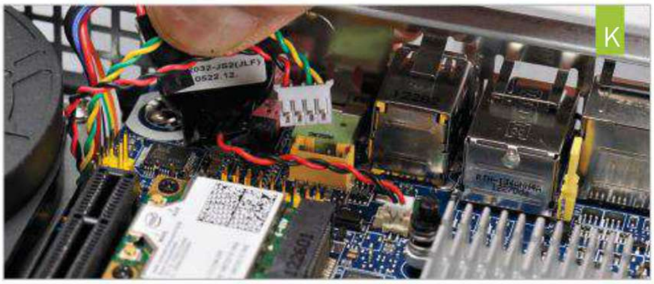




8

BRING THE NOISE

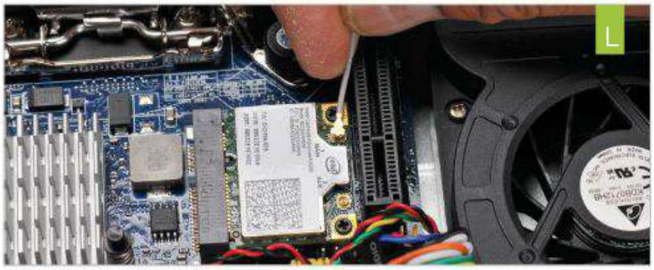
AGAIN, EVERYTHING in the AiO uses internal headers rather than external ports. If you want to use the AiO's internal speakers, you'll need to plug them in using the 4-pin header located near the Wi-Fi card and CMOS battery (**image K**). It's keyed to only fit in one direction.



9

CONNECT WI-FI

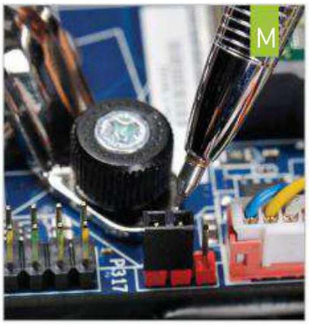
SOME AIO units come with multiple antennas, but Loop chose a single antenna for this chassis. We won't debate the wisdom of a single antenna, but it can create some confusion for newbs. Just look for the small gray antenna lead and plug it into the port labeled "Main 1" on the Wi-Fi card. It should snap into the socket with light pressure (**image L**).

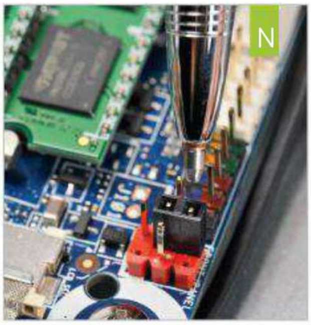


10

SET THE VOLTAGE

YOU NEED TO configure the motherboard's headers for the correct voltage. First, check the 3-pin header next to the "FPD Power" inverter header that you plugged in earlier. By default, it should be set to pins 2 and 3, or 19 volts, which is correct for the Loop (**image M**). You'll want to check the manuals for your AiO and your motherboard, as setting the voltage incorrectly can damage the inverter. You also need to set a secondary inverter header to the correct voltage. This header is located near the front-panel connector and should be set to pins 4 and 6, for 5 volts (**image N**). This is the default position for the Intel motherboard and the correct voltage for the Loop.





11

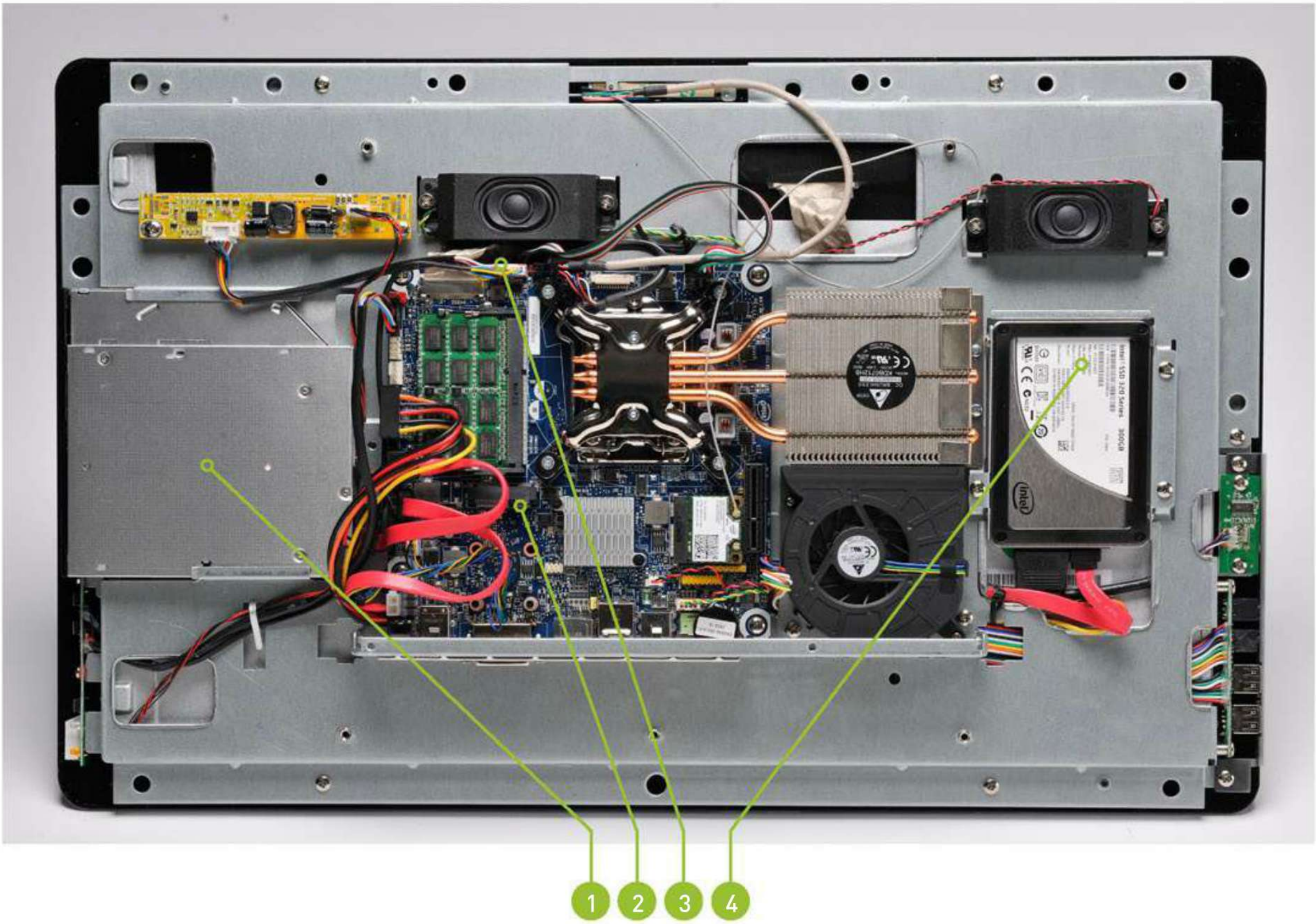
CONNECT FINAL PLUGS AND BUTTON UP

YOU'LL ALSO need to plug in the three USB headers as well as power and data cables for the optical drive and SSD, and you need to plug the SATA power cable into the motherboard. All that needs to be done now is to attach the back cover (while you plug the cover's auxiliary fan into an open fan header) and attach the stand. Now, just plug in your power brick and fire her up!

12

WELL, ALMOST...

INTEL'S MOTHERBOARD comes in an older rev, the G23736-503, and a newer rev, the G23736-504. If your board is a 504 or up, drive on. If it's older, you'll need to update the BIOS because the older board defaults to external graphics rather than the LVDS connector. No worries, you can update the board by just dropping the latest BIOS from the Intel website in the root of a USB key, removing the jumper from the BIOS_CFG header, and booting the machine. The board should automatically update after two minutes. Once the rig's blue system LED stops flashing, you can power down, replace the BIOS_CFG header, and move on. Even if you have the newer board, there is one setting you need to change. Go into the BIOS and then into the Video settings, and in the setting for All-in-One Chassis, set it to the chassis in use. In this case, it's the LP-2150. It's recommended that you then lock the settings so they can't be changed without going into maintenance mode.



1. Unlike most AiO units from the big boys, the DIY AiOs are familiar ground to builders.

2. The Thin Micro-ITX Intel board runs off a power brick and has a fixed CPU location.

3. You'll need to jumper two sets of headers to match the voltage for your AiO's panel.

4. The 300GB 320 Series SSD pictured here was eventually shelved in favor of a more economical 240GB 335 Series Intel SSD.

DIY AIO SHOWS A LOT OF PROMISE

BUILDING THE average desktop PC has long been a labor of love. Sure, in the old days you could save a serious chunk of change when you built your own rig, but these days it's pretty hard to get a better price than a large or even medium OEM that buys parts by the container-full. That's apparently not the case with all-in-ones, where it's possible for builders to have a price edge. Lenovo, for example, offers a 20-inch AiO with the same CPU, 180GB SSD, and 4GB of RAM for about the same price as our Loop build. Granted, some OEMs offer a feature not available to this platform—a discrete GPU. That's actually one of the holes we see in the current push for a DIY platform. Why no GPU provision? In the past, graphics vendors haven't been the greatest at sticking to specs, so that could be the reason, but we think a unified AiO graphics spec is necessary if this category is really going to take off.

As to how our AiO performed—not bad. Our zero-point AiO is an Asus ET2701 INKI-B046C with a Core i7-3770S and GeForce GT 640M. Naturally, the $1,500 Asus, with its 27-inch panel, pricier CPU, and discrete graphics outshines our Loop build, but it's a good reference for what our DIY AiO can do. Clearly, that extra $400 on the zero-point gets you more performance. Our DIY AiO performed respectably though, except in gaming. Intel HD4000 graphics are probably best suited for Portal 2–level and lower gaming. For today's integrated graphics, Metro 2033 is way beyond its pay grade.

Overall, we're pretty happy with the brave new world of DIY AiOs. Yes, it has some maturing to do, but giving enthusiasts the ability to customize an AiO to their own needs (or a parent's needs) is a pretty strong argument for doing it yourself.

BENCHMARKS

	Loop L5	Asus ET2701 INKI-B046C
3DMark 11	P449	**P1,937**
Metro 2033 (fps)	10.9	**29**
Adobe Premiere Pro CS3 (sec)	857	**404**
MainConcept (sec)	985	**919**
ProShow Producer 3.0 (sec)	591	**486**

Best scores are bolded. Our zero-point AiO features a Core i7-3770S, 8GB of DDR3/1600, a GeForce GT 640M, and a 2TB 7,200rpm HDD. Metro 2033 is run at 1280x720, medium quality, DX10 mode, with 4x AA and 4x MSAA.

BUILD IT

NATHAN EDWARDS **SENIOR EDITOR**

A Small but Mighty Gaming Rig

It's not as wee as our Wee Ass-Kicking Machine, but it kicks more ass

LENGTH OF TIME: **2 HOURS** | LEVEL OF DIFFICULTY: **INTERMEDIATE**

SEVERAL YEARS AGO, we built an awesome Mini-ITX gaming rig dubbed the Wee Ass-Kicking Machine. It featured a Core i7-870 CPU, a GeForce GTX 460 GPU, 4GB of DDR3, a 1TB hard drive, and a 120GB SSD—all crammed into a Silverstone SG07 chassis not much larger than a shoebox. The total cost? Around $1,600 (at the time).

It's been a while since then, so I thought it was high time we built another Mini-ITX gaming rig. This one's not quite as small, but it's got a lot more oomph. We're using the BitFenix Prodigy, which has room for a full-size ATX PSU, scads of hard drives, and even a 240mm radiator (if you swing that way), while still being small enough to be lugged around by its convenient carrying handles.

LET'S SEE WHAT FITS

JUST BECAUSE this is a Mini-ITX build doesn't mean we're messing around with integrated graphics. Pah. Pshaw. And other expressions of contempt. Nope, when we build a gaming rig, we use a real discrete graphics card. This time we're going with an MSI GTX 670 Power Edition, which is factory overclocked but still sips power like the rest of the Kepler lineup. We'll use our sweet-spot Ivy Bridge CPU, the 3.4GHz Core i7-3570K, on a Zotac Z77 WiFi Mini-ITX board. The board has one full-size x16 PCIe 3.0 slot, two DIMM slots, USB 3.0, and 6Gb/s SATA. We'll fill those DIMM slots with two 4GB Corsair Vengeance DDR3/1600 DIMMs, and use a 240GB Corsair Force GS SSD and a 3TB HGST Deskstar for mass storage.

The most important part of the build is the case. The BitFenix Prodigy is large for a Mini-ITX chassis, but that just means there's room for more stuff. It can accommodate a full-size PSU (although 140mm is really the maximum depth), up to six hard drives and six SSDs, a long videocard, and, thanks to its big main compartment, a full-size air cooler or even a liquid cooler.

Because most of our favorite air coolers would interfere with the PCIe slot, and we didn't want to give up the lone 5.25-inch bay just so we could install a 240mm radiator, we opted for an all-in-one liquid-cooling loop: Thermaltake's Water 2.0 Performer. This will give us plenty of headroom for overclocking the 3570K to a steady 4.4GHz.

BUILDING IT

The Prodigy is roomy for a Mini-ITX case, but that still means it's a bit of a complicated build. Here's what I had to do.

INGREDIENTS

	PART	URL	PRICE
Case	BitFenix Prodigy	www.bitfenix.com	$80
PSU	Thermaltake Smart Series 730W	www.thermaltakeusa.com	$99
Mobo	Zotac Z77-ITX WiFi	www.zotacusa.com	$178
CPU	Intel Core i7-3570K	www.intel.com	$220
Cooler	Thermaltake Water 2.0 Performer	www.thermaltakeusa.com	$60
GPU	MSI GTX 670 Power Edition 2GB	ww.msi.com	$430
RAM	8GB Corsair DDR3/1600 Vengeance	www.corsair.com	$49
Optical Drive	Samsung SH-222AB CD/DVD burner	www.samsung.com	$20
SSD	240GB Corsair Force GS	www.corsair.com	$220
Hard Drive	3TB HGST Deskstar	www.hgst.com	$160
OS	Windows 7 Professional 64-bit (OEM)	www.microsoft.com	$139
Misc	3-pin-to-Molex adapter	www.amazon.com	$4
Total			**$1,659**

1

PREP THE CASE

REMOVE THE four thumbscrews holding the side panels in place and remove the panels. Pop the four clips holding the front panel in place, and remove that too. Grip the top hard drive cage by its top and bottom clips and slide it out of the case. Turn the case on its side and remove the six screws holding the lower cage to the chassis and remove that cage **(image A)**.

A

2

ADD THE SSD

ATTACH THE SSD to one of the case's six mounting points—either at the bottom of the case, the inside of the left side panel, or the side of the PSU compartment **(image B)**. It doesn't really matter which of the many SSD mount points you use. You could just mount the SSD into one of the hard drive trays, but it'd be nice to leave those free for additional hard drives later on. Replace the hard drive cage. Stand the case upright.

B

3

OPENING THE CASE

FLIP OVER the front panel and remove the two screws holding the optical drive bezel in place **(image C)**. On the front of the chassis, pry off the metal bezel in front of the optical drive tray. Replace the front panel and slide the optical drive into the bay, stopping when it's flush. Secure with the same M3 screws you used for the SSD.

4

ADD THE PSU

UNSCREW the four thumbscrews securing the PSU backplate. You'll want as short a PSU as you can get for this: anything longer than 140mm and you'll have a hard time routing the cables. As tempting as it is to go modular, a nonmodular PSU will be easier to deal with here. Attach the backplate to the PSU and install it into the chassis, but don't put all four thumbscrews back in, as you may want to be able to slide the PSU out later for ease of wiring **(image D)**.

5

CPU AND COOLING

REMOVE THE CPU socket protector and install the CPU. Lower the gate arm to secure it **(image E)**. Add the RAM. Although the Prodigy has room for the large skyscraper-style air coolers we like in our builds, those coolers don't play nice with our solitary PCIe slot, so we're going with a water cooler.

Thermaltake's Water 2.0 Performer (catchy!) is an Asetek-built dual-fan 120mm all-in-one cooler that should keep our CPU nice and chilly. But first we have to install the backplate. Find the Intel backplate and assemble it for Socket 1155 per Thermaltake's instructions. Attach it to the rear of the motherboard. Assemble the retaining clips and screws in the socket ring.

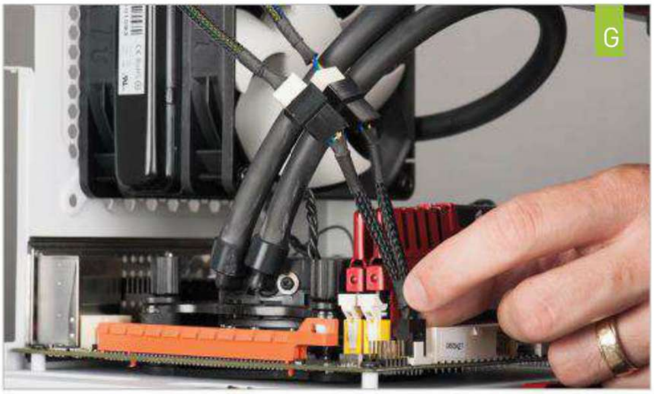
Take the motherboard I/O shield, pop off the tabs covering the Wi-Fi antenna ports, and install it into the case back. Unscrew the case's 12cm exhaust fan and set it aside. Install the motherboard into the case using four screws **(image F)**.

6

ADD THE COOLER

TAKE THE all-in-one cooler and one of the 12cm fans, as well as four of the mounting screws and four washers. Run the screws through the washers, through the mounting holes at the back of the case, through the fan (making sure it's oriented to exhaust out of the case), and into the mounting holes on the radiator. Attach the pump unit to the CPU with the socket ring. Turn to tighten, alternating in an X pattern.

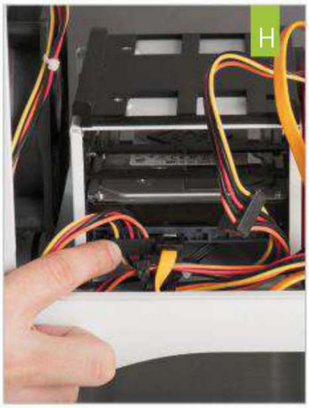
Take the other fan, positioned to blow air through the radiator out of the case just like the first, and install it on the side of the radiator. Plug the fans into the included Y cable and into the CPU_FAN header, and plug the pump unit into the SYS_FAN header near the SATA ports **(image G)**.

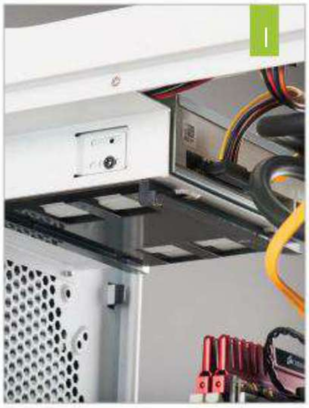


7

ROUTE THE POWER

NOW IS a good time to route some power-supply cables. Bring the 8-pin and 24-pin ATX power cables and one PCIe cable around the front of the PSU to the right side of the case. Route a SATA power cable along the left side to the hard drive bays, connect one port to the hard drive, then terminate it at the SSD, leaving the middle port for a future second drive **(image H)**. Route the other SATA power cable along the bottom of the case, up the front panel, and into the routing hole just above the optical drive. Pop the top fan filter off and route the cable above the optical drive and plug it in **(image I)**. Route SATA data cables from the blue 6Gb/s SATA ports to the SSD and HDD, and route one from a red 3Gb/s port to the optical drive.

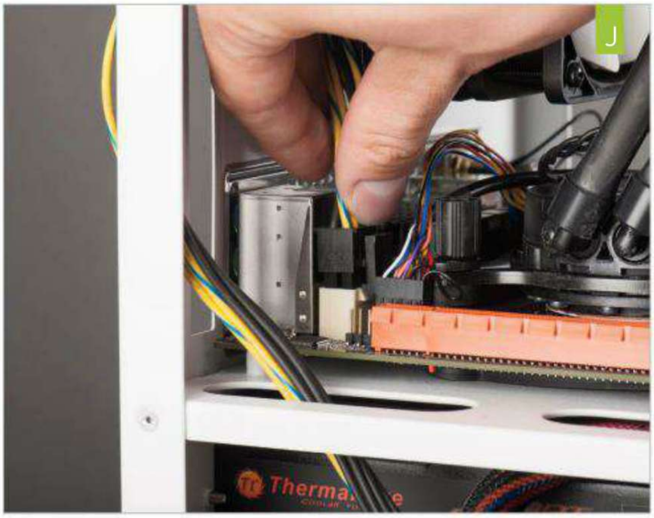




8

MORE ROUTING

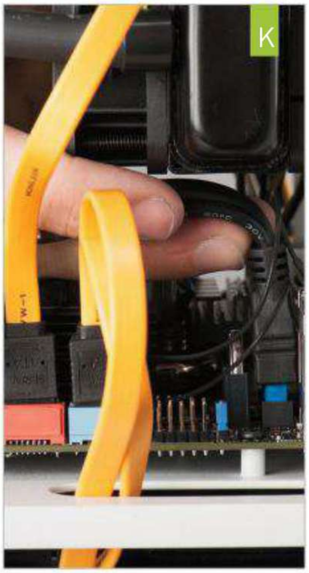
DISCONNECT the HD_Audio cable from the side panel and connect the motherboard end to the mobo, as the port will be impossible to access once the GPU is in place. Run the 24-pin motherboard power cable through the front of the PSU casing and into the port on the motherboard. Run the 8-pin through the cutout toward the rear of the casing **(image J)** and plug it in. At this point you can reattach the top hard drive cage if you want; I've left it out to improve airflow.

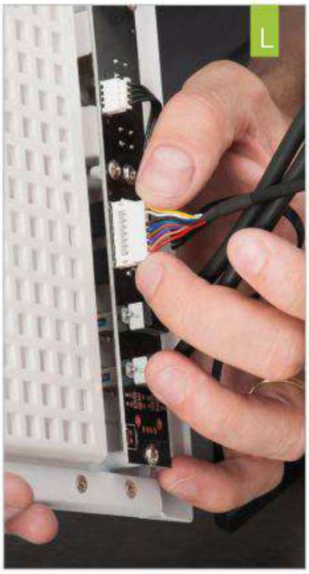


9

ATTACH FRONT-PANEL CONNECTORS

PLUG THE USB 3.0 header into its place below the radiator **(image K)**. Connect the front 12cm fan to a 3-pin-to-Molex adapter and connect that to one of the Molex adapters. Re-attach the other end of the HD_audio cable to the left side cover **(image L)** and put the cover back on the side, pulling the front-panel headers through toward the GPU slot and plugging them in.

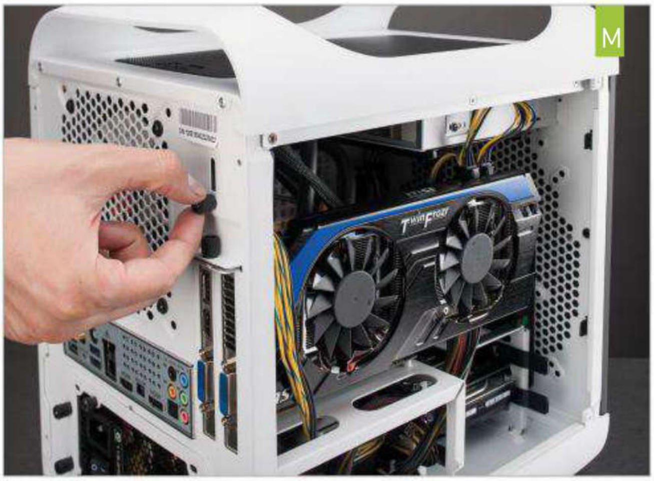


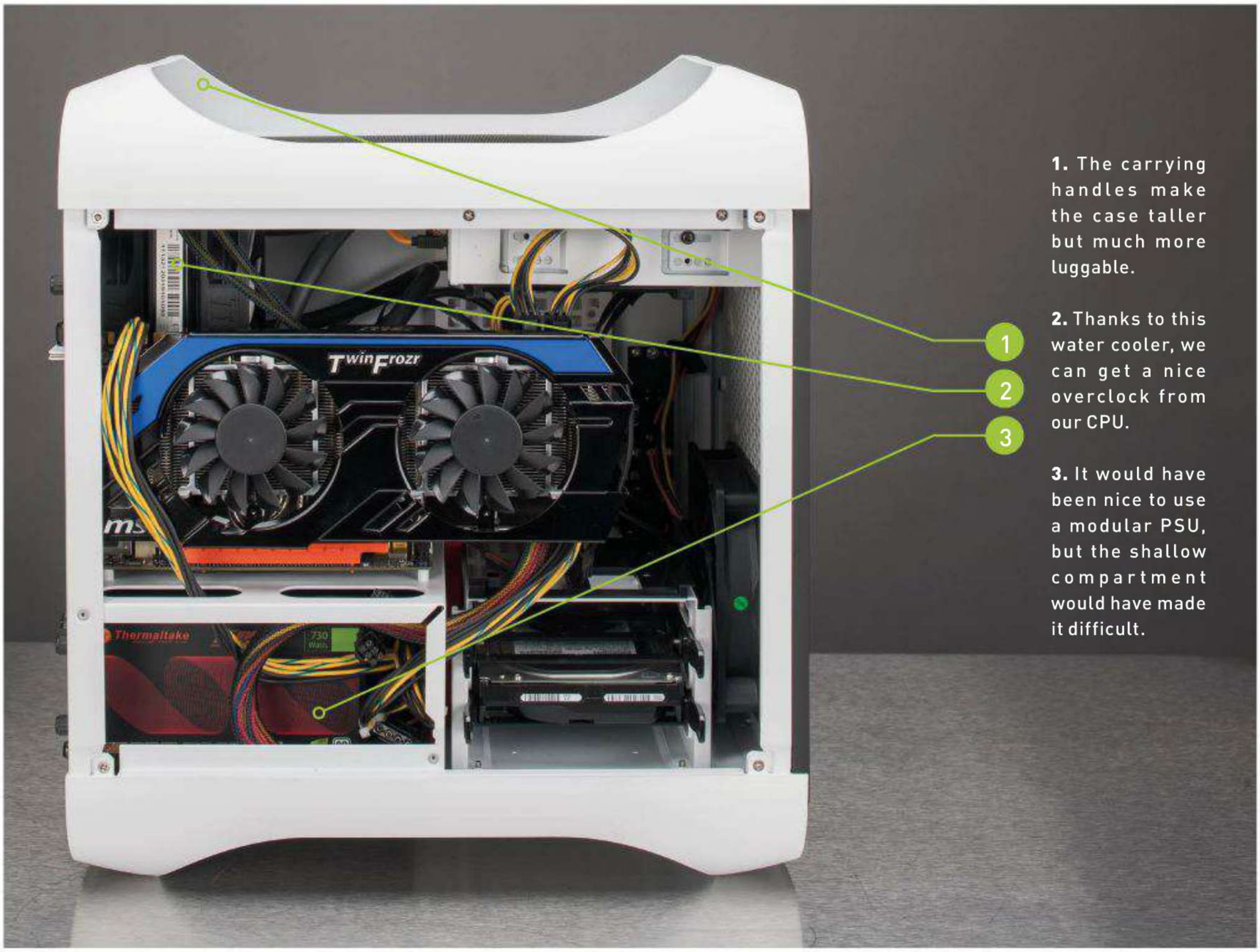


10

INSTALL THE GPU

UNSCREW the expansion-slot cover plate and the expansion-slot covers, and remove them. Install the GPU, making sure the 8-pin ATX power cable can still reach its plug. Replace the cover plate and secure both it and the GPU with the three thumbscrews **(image M)**. Run the PCIe power cable through the same hole as the ATX power cable and plug both 6-pin plugs into the GPU. Secure the PSU plate to the chassis with its four thumbscrews, double-check your wiring, and close the case back up. Screw the Wi-Fi antennae into their posts on the I/O ports.





1. The carrying handles make the case taller but much more luggable.

2. Thanks to this water cooler, we can get a nice overclock from our CPU.

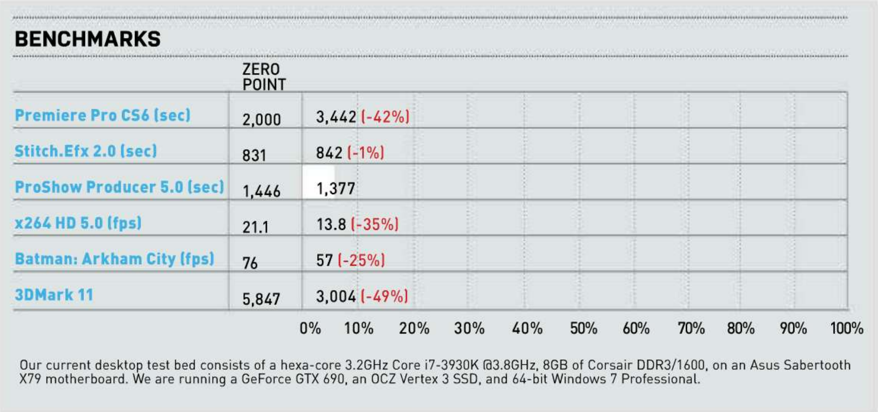
3. It would have been nice to use a modular PSU, but the shallow compartment would have made it difficult.

FIRING IT UP

THE FIRST THING I did with the mini machine was boot into the BIOS and do a simple multiplier overclock on the CPU. I left the stock voltages and bclock the same but cranked up the turbo multipliers on all the cores to 44 for a single core, 43 for two cores, and 42 for more. This gave me a nice, stable conservative overclock of up to 4.4GHz for single-threaded tasks. The MSI GTX 670 is factory-overclocked, so I resisted further overclocking in an attempt to keep the noise from its fans down.

Against our zero-point, the mini-rig loses in every benchmark save ProShow Producer, where its high clock speeds are more important than the zero-point's 12 threads. But our zero-point has a hexa-core CPU , a dual GPU, and costs a lot more money—and it's not nearly as portable. For the price, we get a hell of a lot of rig in a small footprint, and we even get carrying handles. Besides, the fast CPU and GPU on this baby mean that it's still blisteringly good.

The downside of Mini-ITX is that you only get one PCIe slot and two RAM slots, so you've got to be judicious with your build. The good news is that this machine still has room for all the essentials and no wasted space, while still being upgradeable. We'd gladly build into the Prodigy again, and we're pleased we can build a kick-ass (and luggable) rig in such a small package.



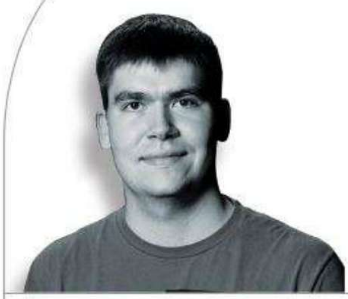
BENCHMARKS

	ZERO POINT	
Premiere Pro CS6 (sec)	2,000	3,442 (-42%)
Stitch.Efx 2.0 (sec)	831	842 (-1%)
ProShow Producer 5.0 (sec)	1,446	1,377
x264 HD 5.0 (fps)	21.1	13.8 (-35%)
Batman: Arkham City (fps)	76	57 (-25%)
3DMark 11	5,847	3,004 (-49%)

Our current desktop test bed consists of a hexa-core 3.2GHz Core i7-3930K @3.8GHz, 8GB of Corsair DDR3/1600, on an Asus Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional.

BUILD IT

CHRIS ZELE **INTERN**

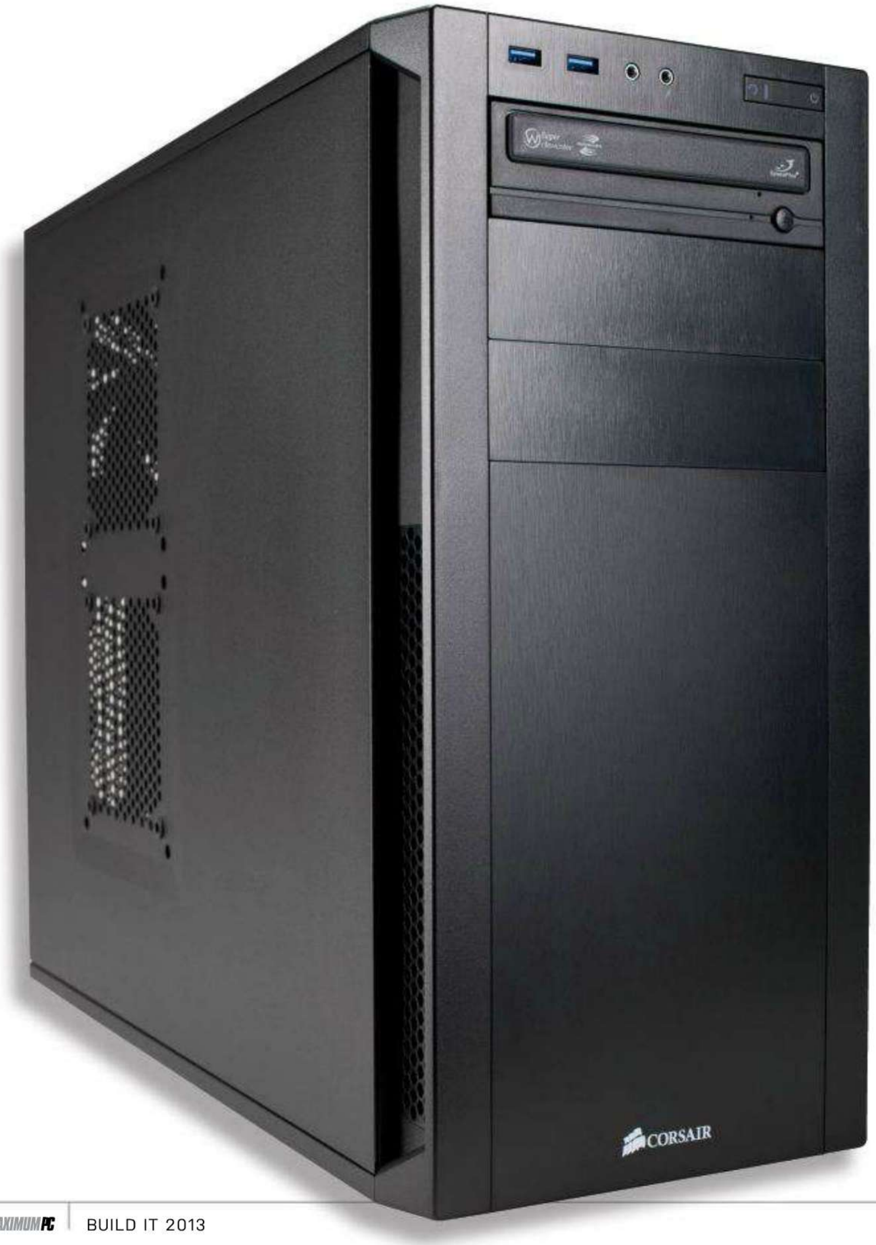


An Affordable Linux Gaming Rig

We show you how to pick the best parts, pick the best distro, and put it all together

LENGTH OF TIME: **2 HOURS**

LEVEL OF DIFFICULTY: **INTERMEDIATE**



THE MISSION The free Linux operating system has been around for ages, but its inherent complexity and limited support has always relegated its use to extreme enthusiasts, programmers, and other hardcore types. That might be changing, though, as a lot of loyal PC enthusiasts are less than pleased with Windows 8, and gaming juggernaut Valve has thrown its hat into the ring by launching a Linux version of Steam, its popular online content delivery service. Given the lackluster reception of Windows 8 and the renewed popularity of Linux, we decided to build a Linux gaming box to see for ourselves whether the OS, at this time, could be a reasonable alternative to Windows for gaming.

CHOOSING THE HARDWARE

OUR LINUX MACHINE was built with a low target price of $650 because we wanted this project to be semi-easy to duplicate by anyone. With this in mind, we started with Intel's Ivy Bridge Core i3-3220 processor, as it comes at a reasonable cost, gives us a great upgrade path, and its low TDP of 55W means we won't need a massive CPU cooler or PSU. Our Asus P8Z77-V LE motherboard is also affordable while offering both SLI and CrossFire support, as well as two USB 3.0 ports. Power is provided by a CX430 Corsair power supply from the company's low-cost Builder series. Given our modest build-out, we figured anything bigger than 430W would be overkill.

GPU duties are handled by a Gigabyte GTX 650 video card, which at $120 performs better than a Radeon HD 7750 and should be sufficient for our Linux adventure. The system requirements of the available games are very low, so a more powerful GPU would be wasted. As our budget didn't allow for an SSD, we went with a 500GB, 7,200rpm WD Caviar Blue. We scored 8GB of G.Skill Ripjaws RAM because it was dirt cheap at just $45. Holding all the gear is a Corsair Carbide case, which is just $60 but has USB 3.0 front panel ports, cable routing, and tool-less drive bays.

With the hardware in hand, it's time to build the machine. If you need any guidance putting it together, check out this step-by-step guide from a previous build: http://bit.ly/wNwJyQ.

Now, let's turn your new box into a Linux gaming rig.

INGREDIENTS

	PART	URL	PRICE
Case	Corsair Carbide 200R	www.corsair.com	**$60**
PSU	Corsair CX430W	www.corsair.com	**$50**
Mobo	Asus P8Z77-V LE Plus	www.asus.com	**$160**
CPU	Intel Core i3-3220	www.intel.com	**$130**
Cooler	Stock Cooler	www.intel.com	**$0**
GPU	Gigabyte GTX 650	www.gigabyte.com	**$120**
RAM	8GB G.Skill Ripjaws	www.gskill.com	**$45**
Optical Drive	Samsung S224BB	www.samsung.com	**$20**
Hard Drive	500GB WD Caviar Blue	www.wdc.com	**$65**
OS	Ubuntu 12.04 LTS	www.ubuntu.com	**$0**
Total			**$650**

1

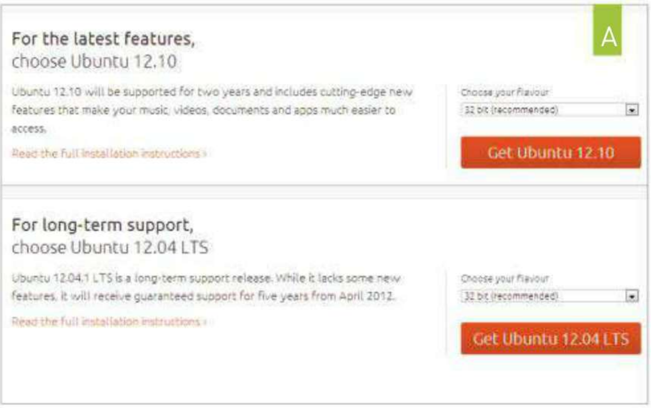
DOWNLOAD YOUR DISTRO

WE CHOSE the Ubuntu flavor of Linux for this project because it's considered the easiest to use for beginners. To get started, we headed to the website (www.ubuntu.com) and downloaded our preferred flavor (**image A**). We chose version 12.04 LTS because it will be supported for five years rather than the latest 12.10 version, which will be only be supported for two years. After the download was complete, we prepared to burn the ISO image to a blank CD-R.

2

BURN THE ISO TO DISC

WE HAD TO find suitable software for burning the ISO to CD-R (at 695MB, the distro fits on one disc) since Windows 7 doesn't natively allow burning ISO files like Windows 8 does. After searching, we settled on the free and easy-to-use Active@ ISO Burner. Go to www.ntfs.com/iso-burning.htm for the download, then run it. Browse to the ISO, select your optical drive, and hit the Burn button (**image B**). When it's done, pop the disc into the optical drive of your new guinea rig, and prepare to install Linux.



For the latest features,
choose Ubuntu 12.10

Ubuntu 12.10 will be supported for two years and includes cutting-edge new features that make your music, videos, documents and apps much easier to access.

Read the full installation instructions ›

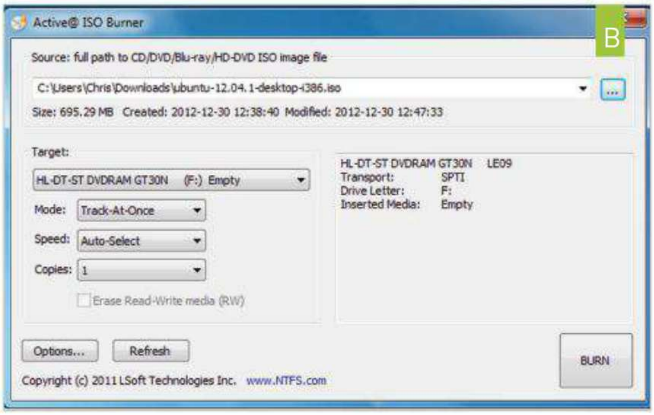
Choose your flavour: 32 bit (recommended)

For long-term support,
choose Ubuntu 12.04 LTS

Ubuntu 12.04.1 LTS is a long-term support release. While it lacks some new features, it will receive guaranteed support for five years from April 2012.

Read the full installation instructions ›

Choose your flavour: 32 bit (recommended)



Source: full path to CD/DVD/Blu-ray/HD-DVD ISO image file

C:\Users\Chris\Downloads\ubuntu-12.04.1-desktop-i386.iso

Size: 695.29 MB Created: 2012-12-30 12:38:40 Modified: 2012-12-30 12:47:33

Target: HL-DT-ST DVDRAM GT30N (F:) Empty

Mode: Track-At-Once

Speed: Auto-Select

Copies: 1

☐ Erase Read-Write media (RW)

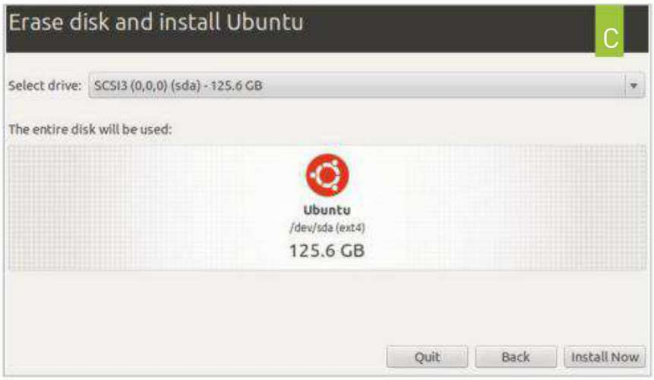
HL-DT-ST DVDRAM GT30N LE09
Transport: SPTI
Drive Letter: F:
Inserted Media: Empty

Copyright (c) 2011 LSoft Technologies Inc. www.NTFS.com

3

INSTALL THE OS

THE BIGGEST DECISION you'll have to make when installing Linux involves drive partitioning (a partition is a chunk of a storage device that appears to the OS as a separate volume). If you're multibooting, install Linux to a separate partition, but if you're like us and just want to run it off one storage device, you can ignore partition options (image C). After you've finished (or skipped) partitioning your hard drive, the OS will begin to install. It took about 30 minutes on our 7,200rpm drive, but it will take about 10-15 minutes on an SSD (we tested it just for fun).



C

Erase disk and install Ubuntu

Select drive: SCSI3 (0,0,0) (sda) - 125.6 GB

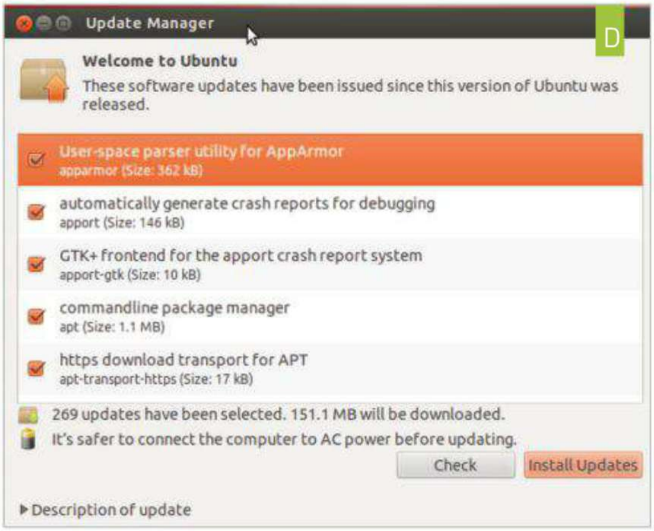
The entire disk will be used:

Ubuntu
/dev/sda (ext4)
125.6 GB

4

UPDATE THE OS

JUST LIKE WITH Windows, the first thing you'll want to do after you've installed Ubuntu is update the operating system. To do so, you will need to grab the latest updates from the Update Manager. Do this by clicking the power button in the right-hand corner of the screen and then clicking Update Manager to see a list of the latest updates; click Install Updates (image D). Unlike with Windows, which can take days to get up to date if you're not using a Service Pack, the update process for Ubuntu took about 15 minutes. After that and a single reboot, we were up to date.



D

Update Manager

Welcome to Ubuntu

These software updates have been issued since this version of Ubuntu was released.

- ☑ User-space parser utility for AppArmor
  apparmor (Size: 362 kB)
- ☑ automatically generate crash reports for debugging
  apport (Size: 146 kB)
- ☑ GTK+ frontend for the apport crash report system
  apport-gtk (Size: 10 kB)
- ☑ commandline package manager
  apt (Size: 1.1 MB)
- ☑ https download transport for APT
  apt-transport-https (Size: 17 kB)

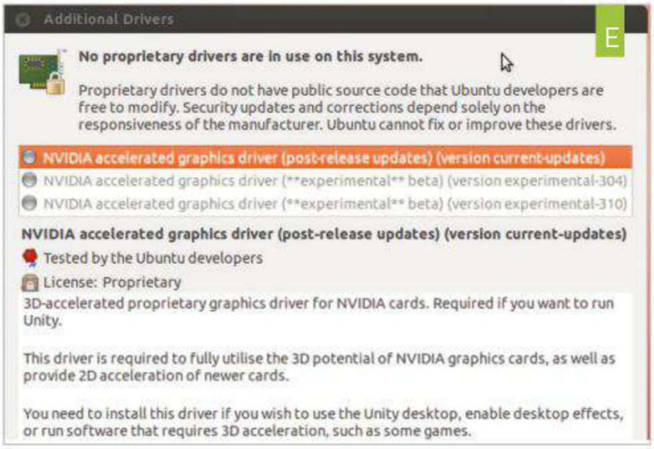
269 updates have been selected. 151.1 MB will be downloaded.

It's safer to connect the computer to AC power before updating.

5

INSTALL VIDEO/SOUND DRIVERS

THE LAST THING you'll need to do before installing Steam is to install the latest video drivers and other non-open-source or proprietary drivers, such as those for your motherboard. To install these drivers you'll simply click the green video-card icon in the right-hand corner of the screen, which pops up a window that displays the proprietary drivers for your computer (image E). One of the cooler features of Ubuntu Linux is that it finds all the available drivers for your system, so you don't have to visit the manufacturers' website to download them. After you've finished downloading the drivers, you'll need to restart your system, and then you'll be completely set up and ready to tackle some games with Valve's Steam client.



E

Additional Drivers

No proprietary drivers are in use on this system.

Proprietary drivers do not have public source code that Ubuntu developers are free to modify. Security updates and corrections depend solely on the responsiveness of the manufacturer. Ubuntu cannot fix or improve these drivers.

- NVIDIA accelerated graphics driver (post-release updates) (version current-updates)
- NVIDIA accelerated graphics driver (**experimental** beta) (version experimental-304)
- NVIDIA accelerated graphics driver (**experimental** beta) (version experimental-310)

NVIDIA accelerated graphics driver (post-release updates) (version current-updates)

Tested by the Ubuntu developers

License: Proprietary

3D-accelerated proprietary graphics driver for NVIDIA cards. Required if you want to run Unity.

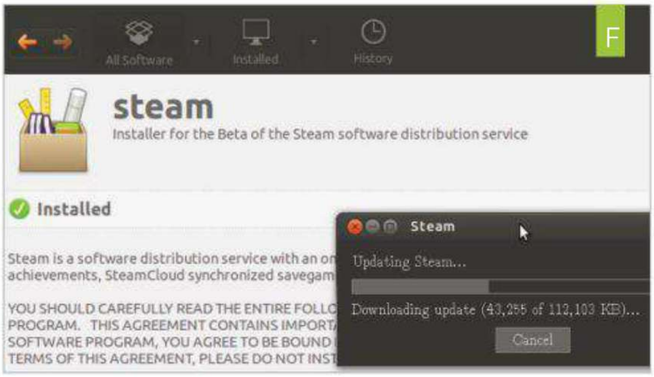
This driver is required to fully utilise the 3D potential of NVIDIA graphics cards, as well as provide 2D acceleration of newer cards.

You need to install this driver if you wish to use the Unity desktop, enable desktop effects, or run software that requires 3D acceleration, such as some games.

6

INSTALL STEAM

INSTALLING STEAM is fairly simple. Download the client from Valve's website (www.valvesoftware.com) and then double-click it to run the installer, which takes you to Ubuntu's Software Center. This Software Center shows you any newly installed software, and it's where we'll install Steam (image F). Once it's installed, you can run the client. But first, you might want to check out other open-source games that are listed in the Software Center, which is a mini app store providing a few games and other small applications for Linux users.



F

steam

Installer for the Beta of the Steam software distribution service

Installed

Steam is a software distribution service with an on
achievements, SteamCloud synchronized savegam

YOU SHOULD CAREFULLY READ THE ENTIRE FOLLO
PROGRAM. THIS AGREEMENT CONTAINS IMPORT
SOFTWARE PROGRAM, YOU AGREE TO BE BOUND
TERMS OF THIS AGREEMENT, PLEASE DO NOT INST

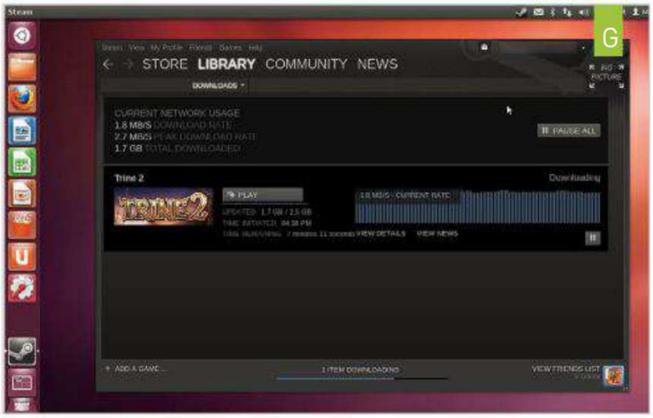
Steam

Updating Steam...

Downloading update (43,255 of 112,103 KB)...

7 SET UP STEAM

AFTER INSTALLING Steam, you will need to log into your account and authenticate your computer via email. You can start installing games on your Ubuntu 12.04 machine (**image G**) after your first log-in. As of this writing, there were 41 games available, and just like in Windows, each of them (aside from TF2, of course) costs money. You will also be able to download any of your previously purchased games that are Linux-compatible (Team Fortress 2, for example). Although 41 games isn't very many, Valve has been adding new titles at a steady clip. The company added 15 of the 41 titles in its Linux library in just the first month of the new Steam client's existence.


G
Steam
STORE
LIBRARY
COMMUNITY
NEWS
DOWNLOADS
BIG PICTURE
CURRENT NETWORK USAGE
1.8 MB/S DOWNLOAD RATE
2.7 MB/S PEAK DOWNLOAD RATE
1.7 GB TOTAL DOWNLOADED
PAUSE ALL
Trine 2
Downloading
PLAY
UPDATED 1.7 GB / 2.5 GB
TIME INITIATED 04:38 PM
1.8 MB/S - CURRENT RATE
VIEW DETAILS
VIEW NEWS
ADD A GAME...
1 ITEM DOWNLOADING
VIEW FRIENDS LIST

LIVING LA VIDA LINUX

OVERALL, WE WERE impressed with the experience we had using Linux for Internet browsing, word processing, and playing games. The OS ran surprisingly well on our modest rig. It booted quickly, shut down in a heartbeat, and handled multitasking without any problems. When it comes to gaming, our feeling is that it handles the games we play just fine, but the test bed of 41 offered by Steam at this time is too small a sample—we want more! We know Steam is not the only supplier of games, but we're still talking about a relatively small gaming universe on Linux. As an example, Steam offers more than 6,000 titles on the Windows platform, so clearly no hardcore gamer can survive on Linux alone. Also, there are zero triple-A titles on Steam for Linux at this time—that right there is a deal-killer for us, at least in the long run. In testing, we sampled Team Fortress 2, Trine 2, and Waveform, and they all ran with ease at 1920x1200 on our budget box, with all settings maxed. We were greatly impressed by just how smoothly the games hummed along.

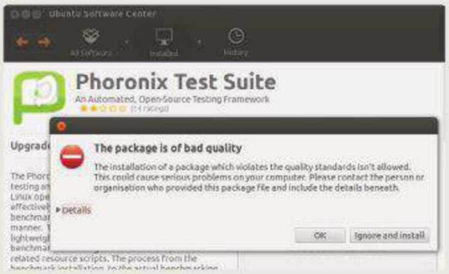
Just because we can't survive on Linux alone doesn't mean we didn't like experimenting with it on the side, however. Building the Linux gaming box was a fun experience, and we'd recommend any enthusiast take it for a test drive. Besides, both Linux and Steam are free, so trying either one won't cost you a dime.

CORSAIR
CX430

WHERE ARE THE BENCHMARKS?

We know your eyes are scanning the pages looking for some hard numbers, but sadly, we don't have any benchmarks this time around. We wish we did, but Linux isn't very well supported by software developers who make benchmarking tools. We can tell you that to our eyes, all the games we tested played well on our GTX 650 at 1080p, running at least 30fps at all times. We were never lacking for GPU horsepower, in other words.

We wanted to try out the Phoronix Test Suite benchmarks, but Ubuntu warned us off installing it with a "bad quality" message. Another possible benchmark is x264, but it's designed to test a machine's CPU rather than its GPU, so it wouldn't paint a complete picture of this system's capabilities. Being a gaming machine, most people—ourselves included—are more interested in GPU performance and specific frame rates for games, but again, these numbers are hard to come by. None of the games on Steam have built-in benchmarks, and Fraps is Windows-only at this time, along with 3DMark, Catzilla, and all of the other games and programs we typically use. This situation might change now that Valve is pushing the gate open, but until it does, we'll stick with an old favorite—EyeballMark.


Ubuntu Software Center
All Software
Installed
History
Phoronix Test Suite
An Automated, Open-Source Testing Framework
Upgrade
Details
OK
Ignore and install

The package is of bad quality

The installation of a package which violates the quality standards isn't allowed. This could cause serious problems on your computer. Please contact the person or organisation who provided this package file and include the details beneath.

The Phoronix benchmark suite elicits a "bad quality" warning from Ubuntu.

BUILD IT

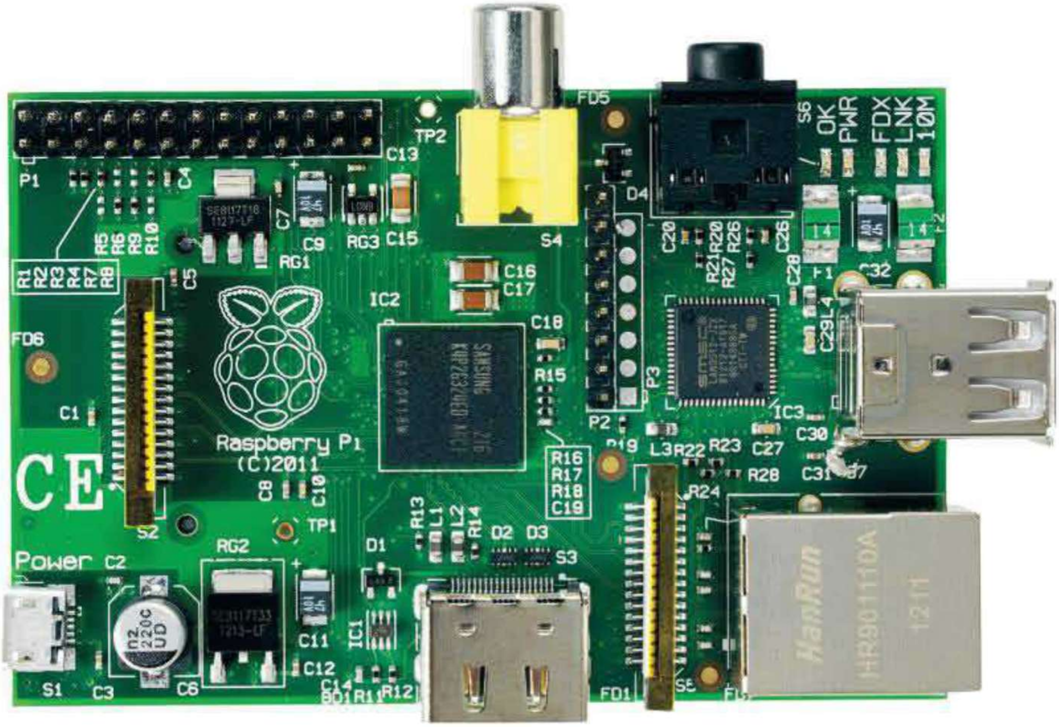
BY JONATHAN ROBERTS

Bake Your Very Own Raspberry Pi

A step-by-step guide to getting up and running with the world's smallest bare-bones PC—the Raspberry Pi

LENGTH OF TIME: **2 HOURS** | LEVEL OF DIFFICULTY: **ADVANCED**

THE MISSION The Raspberry Pi is a tiny bare-bones PC built by a team in the UK who wanted to bring a low-cost computer to the masses. The idea was born of their goal to increase interest in software development, programming, and general hardware hacking. When they found that a lot of young people didn't have access to PCs these days, they baked a Pi to fix the situation. You order the Pi online (www.raspberrypi.org) and it's shipped to you as a simple circuit board with a few components soldered to it, and that's it. There's no operating system, no power supply, no storage or input devices, no instruction manual, and no cables of any kind. This is what you get for $35, in other words. Don't be scared, though; we're here to help. In this Build It we'll show you what peripherals you need, how to create a bootable SD card and boot the system, and what to do once you've got it up and running. Finally, we'll cover what settings you might want to tweak, and what you can and can't do with the Pi currently.



The Raspberry Pi is a credit-card-size Linux PC designed to help people get their feet wet with programming and hardware hacking.

SPECIFICATIONS

CPU/GPU	Broadcom BCM2835 700MHz SoC
RAM	256MB SDRAM
Connectivity	2 USB 2.0 ports, HDMI, composite RCA, SD slot, 10/100 Ethernet, 3.5mm jack
Weight	1.58 oz

WHAT YOU NEED TO GET STARTED

The Raspberry Pi is truly a bare-bones PC, so in order to utilize it in even the most basic ways you're going to need a few pieces of hardware and software first, so let's look at each one individually.

POWER SUPPLY: The power supply has to provide at least 7mA at 5V and have a Mini USB connection. Many smartphone chargers match these specifications, so check yours. We've been using a standard Android phone charger in the office and it works beautifully.

STORAGE: You'll need an SD card, and it must be Class 4 and have at least 4GB of space available. Of course, the more space there is, the more applications and data you'll be able to keep on your Raspberry Pi, so go to town if you want since storage is cheap these days (you can get 32GB for just $20). If you're unsure which to buy, you can find a list of cards known to work at bit.ly/wVO5By. You'll need to be able to read and write to the SD card from a computer other than the Raspberry Pi, so if your PC doesn't have a card reader, you'll need to buy an external reader.

CABLES: The HDMI/composite cable doesn't need to be expensive. You can buy cables online from Monoprice.com for about $5. As for which type of cable you need, HDMI or composite, that depends on what kind of display you're using. If you're hooking up your Raspberry Pi to a very old TV, you'll need to use a composite connection. If your display has a DVI connection, you should buy an HDMI-to-DVI converter, or a dedicated HDMI-to-DVI cable. If it has both composite and HDMI connections, you should opt for the HDMI, as this will give you the best possible image quality.

USB KEYBOARD/MOUSE: Almost any keyboard and mouse combo will do, just be aware that your old PS/2 mouse and keyboard will not work here.

INGREDIENTS

	PART	URL	PRICE
PC	Raspberry Pi	www.raspberrypi.org	$35
PSU	Mini USB Power Supply	www.amazon.com	$5
HDMI Cable	Generic cable from the Internet	www.monoprice.com	$5
Storage	4G SD Card	ww.amazon.com	$5
Media Reader	SD Card Reader	www.amazon.com	$5
Peripherals	USB Keyboard/ Mouse	ww.amazon.com	$30
OS	Debian Linux Distro	www.raspberrypi.org/ downloads	$0
Total			$85

THE OPERATING SYSTEM: Not only do you need extra peripherals before you can get started, the Raspberry Pi is also missing an operating system. To make it work, you need to get a hold of a compatible operating system and write it to the SD card. We'll show you how, below. Note: It's wise to read through all of the steps first before actually embarking on the process.

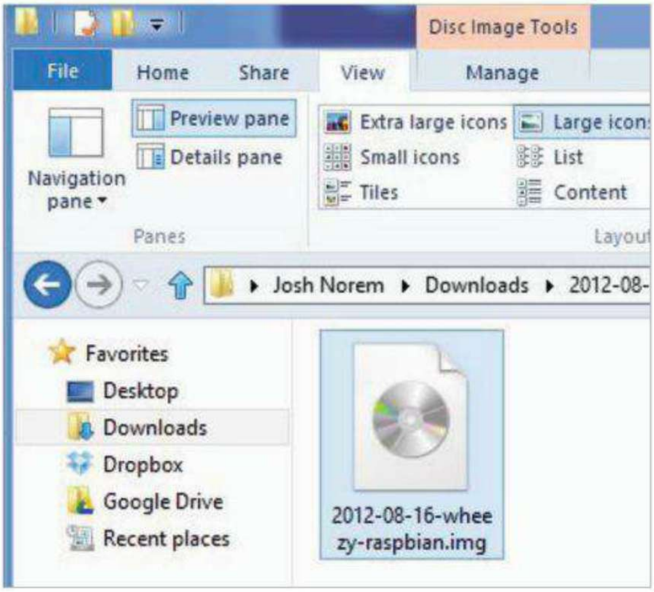
1

ACQUIRE AN OS

TO GET the operating system onto the SD card, you first need to download it. You can find all the compatible operating systems on the Raspberry Pi website: www.raspberrypi.org/downloads. The developers recommend that you download the Debian version for the time being, which is what we're using in this tutorial. The download is large at 400MB-plus, and there are other, slightly smaller versions, but they don't offer Debian's flexibility.

Once you've downloaded the image, you need to connect the SD card to the computer. If your PC has a built-in card reader, use that; if it doesn't, you'll need to connect a USB card reader.

The download is a zip file, which you should extract to its own folder. Inside the newly created folder you'll find an image file with the .img extension—this file needs to be copied on to the SD card, but it can't be copied like a normal file. The .img file, as the name suggests, is an exact image of a storage device. It contains information about the layout of data on the device and files used to boot the computer, which have to be in exactly the right part of the drive. If you just copy it, the files won't be in the right place, but will be stored on top of the disk's existing structure. Instead, we need to copy it in a way that replaces the disk's structure and data with that of the .img file. We'll do this in the next step.



You can run any Linux distro you want on your Pi, but the developers recommend this version of Debian.

2

PREPARE THE SD CARD

WINDOWS USERS will need to use a special program to copy the first byte of the image to the first byte of the disc, the second byte to the second byte, and so on (see sidebar on the right). Linux users can do this using dd, a command-line tool for file-copying.

Using Linux, first put the SD card in your computer, then open a terminal window and type `df -H`. This command will display a list of all storage devices and partitions on your PC, along with their size, allowing you to ascertain the device label your computer has assigned to the SD card.

Look through the list for an entry that has the same size as your memory card, and specifies Media in the Mounted column on the right. You may not find one that's exactly the same size as your card, but there will be something close. Make a note of the information under the Filesystem column; it should be something like `/dev/mmcblk0`.

Next, figure out the path to the downloaded image file. For example, we downloaded it to the downloads folder of our home directory, making its path: /home/maxpc/Downloads/fileX.img.

If you saved it elsewhere on your PC, you'll need to note the full path to that location instead.

Now that you have both the location of the image file and the location of the SD card, head to the command line and make sure you have precise information, as this next command will wipe out anything on the destination device. Ready? OK, enter the following command: `sudo dd if=/home/Maxpc/Downloads/debian6-19-04-2012/debian6-19-04-2012.img of=/dev/mmcblk0`

The part that follows the word "if" is the path to the downloaded image file, and the part after "of" is the SD card location you noted earlier. This will remove all data from the SD card, copy the image file to it, and make it bootable.

3

BOOT UP

WITH THE DANGEROUS part of this project behind us, we can now prepare for our first boot. To do this, simply insert the SD card in the slot on the bottom of the Raspberry Pi, and connect your USB keyboard, mouse, display, and Ethernet cable. Then, with the monitor turned on, connect the power supply and the Raspberry Pi should boot itself.

You'll see a red power light next to the USB connections, and shortly after you should see some flashing green lights. If you don't see these, it means something went wrong with the SD card's formatting. First, unplug the power cable, double-check that the card is pushed into the slot properly, and then reconnect the power. If it still doesn't work correctly, go back and try to configure the SD card again.

If all is well, however, you should see a lot of text scroll by on the screen with a Raspberry Pi logo at the top. The first time you start up, it enters a one-off initialization process. Along the way, it may stop loading when it says "Stopping Portmap Daemon"; if it does stop at this point, you can simply turn the power off and on again, and the RPi will start without any difficulty the next time around.

4

MEET THE PROMPT

EVENTUALLY, the text will stop scrolling across the screen and there will be a line at the bottom that reads `raspberrypi login:` followed by a blinking cursor. This is the login prompt, and it means the machine is waiting for you to enter your username and password. On the Debian image, the username is "pi" and the password "raspberry." Type the username and press Enter, and then type the password and press Enter. It won't show your password as you type it, just in case anyone is looking over your shoulder. After doing that, you'll find the text stops at another line, similar to the last time, and it reads `i@raspberrypi:~$` followed by a blinking cursor. This is the command prompt, which is where you type whatever commands you want the Raspberry Pi to execute for you. If you plan to use your Raspberry Pi to learn about computers and how they work, to run your own server or to do some programming, you'll spend more time with the command prompt, but for now let's get the graphical interface working.

WRITING THE SD CARD IN WINDOWS

If you don't have a Linux PC, you can use the free utility Win32 Disk Imager to move the OS onto your SD card. This tool was originally developed to work with the Netbook Remix of Ubuntu, but it has now become a popular tool for people playing with ARM devices (such as the Raspberry Pi). You can download it from bit.ly/Dh2nE. It's simple to use—just select the .img file in the first field, and select the SD card from the Device field next to that. Then all you need to do is click Write to complete the process.

Make sure you get the correct drive, and consider backing up all your data first because it's possible to lose everything if you make a mistake. Also, this tool will erase all information on the SD card, so be careful when using it.

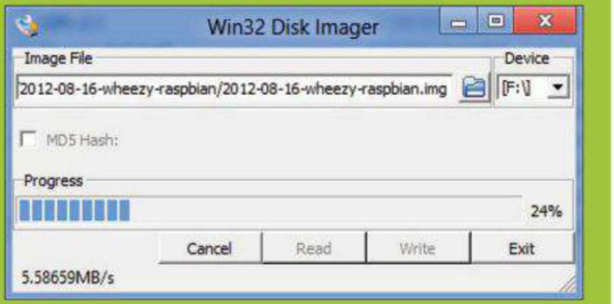


Image File: 2012-08-16-wheezy-raspbian/2012-08-16-wheezy-raspbian.img

Device: [F:\]

☐ MD5 Hash:

Progress: 24%

5.58659MB/s

Windows users can use Win32 Disk Imager to write the OS to the SD card.

5

ENTER THE GUI

AT THE COMMAND prompt, type `startx` and press Enter. The screen will flicker for a few moments, then turn black, then a huge Raspberry Pi logo will appear, with a taskbar across the bottom that's similar to Windows. This is LXDE, the Lightweight X11 Desktop Environment. On Linux, users can choose from many graphical interfaces to interact with their computers. LXDE isn't the prettiest or most modern of these, but it's one of the leanest. This makes it perfect for running on hardware without much processing power or memory, like the Raspberry Pi.

Have a look around and click the different buttons to see what they do—you can't break anything at this point, and even if you did, you could just unplug the Pi and reconfigure your SD card and you'd be back where you started.

Although you can't see the command line anymore, it's running in the background. You can access it again by pressing Ctrl + Alt + F1—try it. You should see some obscure-looking text following the startx command you issued. This is the output from the running program, the X Server.

X is the program that Linux uses to control input devices and display information on the screen. It creates a series of virtual consoles, accessed by typing Ctrl + Alt + [F1–F6]. The graphical environment—on the Raspberry Pi at least—will always be accessible on the console represented by F2. Therefore, to get back to LXDE you just press Ctrl + Alt + F2. One thing you might notice as you play and explore is that the desktop doesn't fit your display properly. This is a common problem that some people using HDMI connections have found. It's caused by something called overscan, which is a relic from television sets made from the 1930s through to the 1990s.

6

FIX THE OVERSCAN PROBLEM

TO FIX THE overscan problem, we'll return to the command line. We won't switch virtual consoles as we did before—we'll use a terminal emulator instead. Open the LXDE menu by clicking the icon in the bottom-left of the screen, then click Accessories>LXTerminal. This is another way to access the command line. In the new prompt window, type `sudo leafpad /boot/config.txt`. This will launch a text editor called Leafpad. You don't need to open a file since the command you entered also specifies which file should be opened to edit—config.txt in the /boot directory. In the new window, type `disable_overscan=1` and then save the file. You can then reboot your Raspberry Pi by clicking the logo in the bottom-right of the screen. When it comes back on, the screen should be filled.

While you're looking at it, there are a lot more options you can put in the config file. A lot of them have to do with display modes like resolution, others cover modifying how fast the processor runs—overclocking it, essentially. The hdmi_drive option is useful if you're using an HDMI-to-DVI converter. Set its value to 1 to ensure your screen is at the correct resolution and reboot.

CAN I GAME ON MY PI?

In a word, no—you can't, but you may be able to in the future. The main problem, aside from hardware limitations, is that the Raspberry Pi is very new, so people have only just started tinkering with the hardware, finding and reporting problems, and creating compatible applications that make the most of its capabilities. Also, you may not be surprised to learn that there are some problems with hardware support in the distributions. So far, none of them have X—the software that controls the display—working properly with the integrated graphics system, which means that it's slow to redraw windows.

It's also impossible to get most existing 3D games to work. This is because most 3D games on Linux have been written to interact with the graphics system through something called OpenGL, but Raspberry Pi supports only a subset of this, called OpenGLES. Hopefully, in the future new games will appear and old games will be modified to work with OpenGLES. We expect to see X gain support for integrated graphics, too.

133fps
20
0
100
100

Gaming isn't the Raspberry's Pi's forte, but at least you can play Quake 3 on it.

7

ESTABLISH STORAGE SPACE

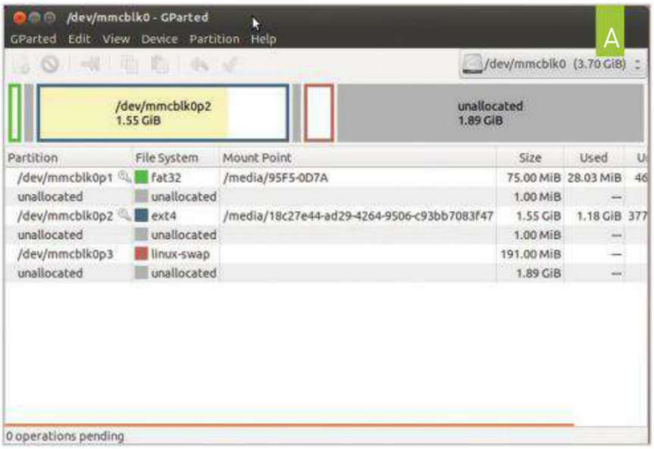
AT THIS POINT, you've got your Raspberry Pi running, you know how to start the graphical interface, and you've set the screen resolution. It's a great start, but there's one more tweak we want to describe: how to configure your SD card to make all its storage space available. The reason this is necessary is that when you put the .img file on to the SD card, it automatically divides the drive into three partitions. One of these is used for storing the operating system and all your files (known as the root partition, represented by a /), another is used for providing virtual memory (known as the swap file), and the third is used for storing the files that let the Raspberry Pi start. Because each is seen as another physical device, if there's room on the SD card that's outside of these partitions, the operating system will ignore it.

The Debian image we put on the SD card creates a root partition that's always the same size (around 2GB). As a result, on our 4GB SD card we found ourselves with 2GB of unused space, and only a few hundred megabytes available to store our new applications and files. To fix this problem and reclaim the wasted space, you'll first need a PC with GParted installed. The app is free and supports both Linux and Windows (available at gparted.sourceforge.net).

Before starting, back up your data. Now, with the SD card in your card reader, run GParted. Look in the drop-down menu and choose a device that's the same size as your SD card. If it's the right one, you'll see three partitions listed in the main window and three segments of unallocated space (**image A**). Right-click the linux-swap partition and select Resize/Move. In the window that appears, drag the small box all the way to the right of the box that it's contained within (**image B**). Click the Resize/Move button at the bottom of the screen.

Next, right-click the ext4 partition, select Unmount (**image C**), then right-click and select Resize/Move. Drag its right-hand edge to the end of the box to resize it. Click Resize/Move. This finalizes the moves we want to make, but nothing has been done yet.

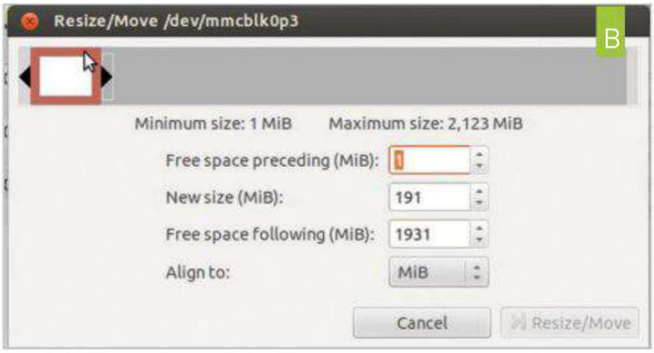
If you're sure you've got it right, click the green tick at the top of the screen, then wait patiently while GParted moves and resizes your partitions (**image D**). Take the SD card out, stick it in your Raspberry Pi, and power it up. ⏻



/dev/mmcblk0 - GParted

Partition	File System	Mount Point	Size	Used	U
/dev/mmcblk0p1	🟩 fat32	/media/95F5-0D7A	75.00 MiB	28.03 MiB	46
unallocated	▨ unallocated		1.00 MiB	—	
/dev/mmcblk0p2	🟦 ext4	/media/18c27e44-ad29-4264-9506-c93bb7083f47	1.55 GiB	1.18 GiB	377
unallocated	▨ unallocated		1.00 MiB	—	
/dev/mmcblk0p3	🟥 linux-swap		191.00 MiB	—	
unallocated	▨ unallocated		1.89 GiB	—	

0 operations pending



Resize/Move /dev/mmcblk0p3

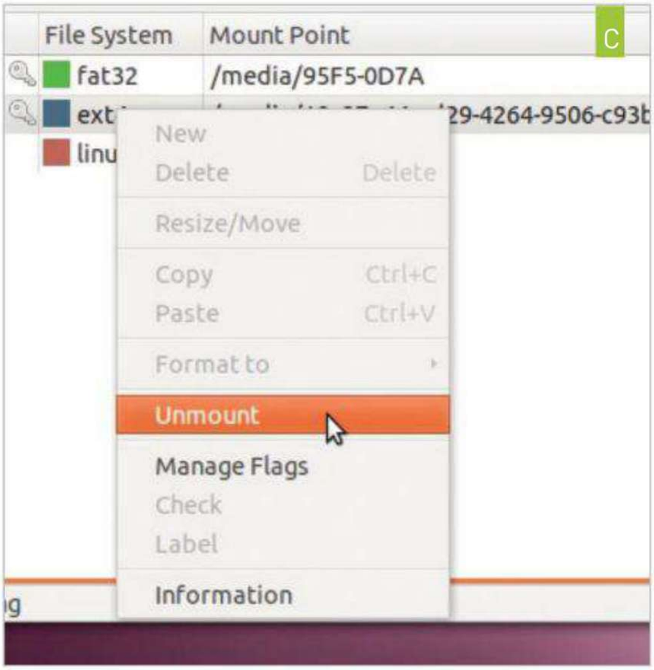
Minimum size: 1 MiB Maximum size: 2,123 MiB

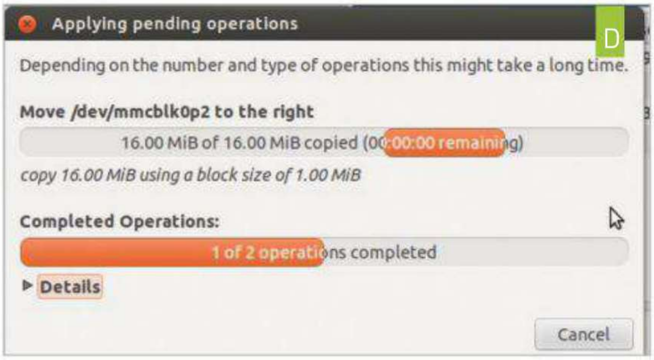
Free space preceding (MiB): 1

New size (MiB): 191

Free space following (MiB): 1931

Align to: MiB





Applying pending operations

Depending on the number and type of operations this might take a long time.

Move /dev/mmcblk0p2 to the right

16.00 MiB of 16.00 MiB copied (00:00:00 remaining)

copy 16.00 MiB using a block size of 1.00 MiB

Completed Operations:

1 of 2 operations completed

BUILD IT

NATHAN EDWARDS **SENIOR EDITOR**

Roll Your Own Home Server

We haven't checked in with FreeNAS, the FreeBSD-based DIY NAS OS, in quite some time. The OS has been completely overhauled, plugin support has been added, and it now works with even more hardware

LENGTH OF TIME: **3 HOURS** LEVEL OF DIFFICULTY: **ADVANCED**

THE MISSION Since the last time we built a FreeNAS box, for the January 2010 issue, the OS has been through some changes. It switched developers, nearly switched platforms, removed media streaming, added it back in via plugins, added better ZFS management, and more. FreeNAS promises near-endless customization and hardware support, enabling nearly anyone to build a highly moddable NAS from off-the-shelf parts. I've been promising an updated FreeNAS build for quite a while, and now's the time to deliver. I assembled a cream-of-the-crop batch of hardware, got the latest version of FreeNAS, and got cracking.

CHOOSING THE HARDWARE

THE BEAUTY OF FreeNAS is that it'll work with just about any old hardware you have lying around—you don't need to build a special box for it. This "build" is more about exploring the new version of FreeNAS than it is about the hardware itself. I took the opportunity to build a pretty powerful system, but you don't have to take my hardware choices as your minimum recommended specs or anything like that. I just wanted to see what would happen if I gave it beefy hardware to play with.

I chose a Fractal Array R2 chassis, which has six drive bays and an integrated PSU. I had a Mini-ITX FM1 board and an AMD A8 APU lying around and decided to use those, because a more capable CPU in your NAS means better transcoding and streaming. You could just as easily use any Mini-ITX board with a PCIe slot, maybe one with an integrated Atom or Brazos chip, if you want to save some money.

Four Western Digital Caviar Red NAS drives at 3TB each give me a theoretical 12TB of capacity if I were just going to make a RAID 0, which I'm not. Because I'll be using a filesystem called ZFS, which does all its volume management in software, I want a good host-bus adapter that doesn't insist on imposing its own hardware RAID over it—just something to pass the commands from the OS to the drives. I picked LSI's SAS-9207-8i, which can control up to eight 6Gb/s drives and runs on a x8 PCIe 3.0 bus. Because I want to use the case's SATA power connectors, I also bought a HighPoint Mini-SAS-to-SATA breakout cable rather than use the included connectors, which run on Molex power.

Because ZFS loves RAM and wants as much as you can throw at it (the specs recommend at least 1GB per TB of storage), I used two 8GB DDR3 DIMMs from G.Skill.

FreeNAS won't mount any storage on the boot drive, and only takes up about 2GB total (with another 2GB swap), so there's no point wasting a hard drive on it. It's perfectly happy booting from a flash drive. I just used an 8GB drive left over from a CES press kit.

INGREDIENTS

	PART	URL	PRICE
Case/PSU	Fractal Array R2 w/300W SFX PSU	www.fractal-design.com	**$200**
Mobo	Asus F1A75-I Deluxe	www.asus.com	**$175**
CPU	AMD A8-3850 2.9GHz APU	www.amd.com	**$100**
Cooler	Stock AMD	www.amd.com	**$0**
RAM	G.Skill RipjawsX	www.gskill.com	**$105**
Boot Drive	8GB Flash Drive	various	**$8**
Hard Drives	3TB WD Red NAS drive (x4)	www.wdc.com	**$880**
Drive Controller	LSI SAS 9207-8i	www.lsi.com	**$305**
SAS-to-SATA cable	HighPoint Int-MS-1M4S	www.highpoint-tech.com	**$10**
OS	FreeNAS 8.2 Release	www.freenas.org	**$0**
Total			**$1,783**

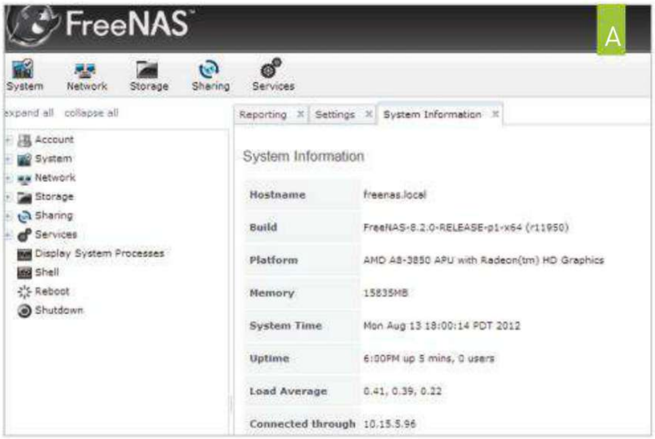
SET IT UP

Since this is a very straightforward build but a complicated software install, I'll skip the step-by-step build entirely, and start with the software configuration. It's a bit of a doozy. Thankfully, I have the excellent instructions on Freenas.org and the FreeNas Quick Start Guide (http://doc.freenas.org/index.php/Quick_Start_Guide) to help. Here's how to set up FreeNAS; create volumes; set up users, groups, and sharing; and install a few streaming plugins.

1 INSTALL THE OS

TO CREATE the bootable OS image (from a Windows machine), you'll need the aforementioned USB drive, the programs 7-Zip (www.7-zip.org) and Win32 Disk Imager (bit.ly/N3QiJT), and the img.xz file for your install. We're using FreeNAS 8.2.0 Release 1. Download the FreeNAS-8.2.0-RELEASE-p1-x64.img.xz file from SourceForge (bit.ly/N3Qvg7). Extract the img.xz file using 7-Zip to turn it into an .img file, then burn that file onto your USB key with Win32 Disk Imager. This might take a few minutes. Once it's ready, plug the USB key into one of the FreeNAS box's rear USB ports and turn on the machine. You'll need a keyboard and a monitor for this, but only for a few minutes. Make sure the FreeNAS box is connected to your network via Ethernet. Make sure the system is set to boot from USB. The system will spend a few minutes doing a self-test and then dump you at a screen called Console Setup. At this point, under a list of 11 options, you should see the phrase "You may try the following URLs to access the web user interface," followed by an IP address. Go to another computer on your network and enter that address into the web browser; you should be able to get right into the web console, which will make this whole process a lot easier **(image A)**.

You'll notice a blinking Alert light on the upper right. Click it and you'll see that you need to change the admin password. Hit the Account button to the left of the Alert button, then select Change Password. Changing the admin username from "admin" can help with security too. You should also set up an email address for the root account, so FreeNAS can email you with admin alerts. Go to Account, then Users, then View Users, and click Change Email on the root account. You should also set up console logging by going to System > Settings > Advanced and selecting Show Console messages in footer.



System Information

Hostname	freenas.local
Build	FreeNAS-8.2.0-RELEASE-p1-x64 (r11950)
Platform	AMD A8-3850 APU with Radeon(tm) HD Graphics
Memory	15835MB
System Time	Mon Aug 13 18:00:14 PDT 2012
Uptime	6:00PM up 5 mins, 0 users
Load Average	0.41, 0.39, 0.22
Connected through	10.15.5.96

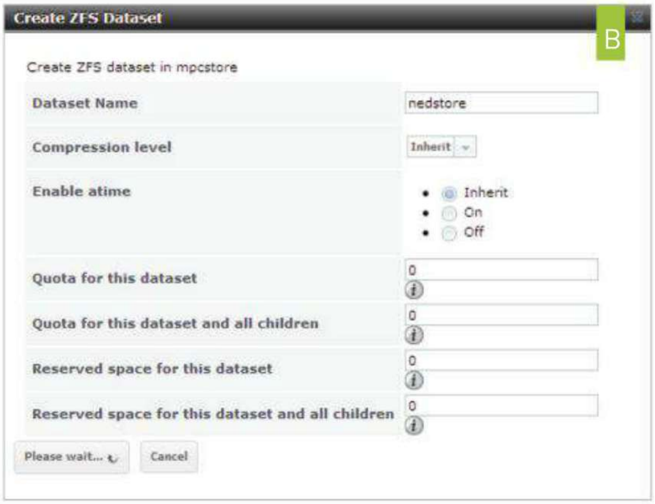
2

SET UP STORAGE

NOW FOR THE fun part: volume management. Thousands of words can be and have been written about the relative merits of the various traditional RAID levels, as well as ZFS-specific types like RAIDZ1 and RAIDZ2. Any choice will be a trade-off between performance, capacity, and robustness. I'm going with RAID-Z2, which will allow me to tolerate up to two disk failures without data loss.

Go to Storage > Volumes > Volume Manager. Create a volume name (I used "mpcstore"), then hold Ctrl and select the drives to use—I used all four drives. For filesystem type, select ZFS, then RAIDZ2. Select Add Volume. My four 3TB drives created a volume of 6TB; I'm sacrificing space for redundancy.

Inside the volume, I'll create individual ZFS datasets so I can set granular permissions on each of them. Because I'm the first user, I'll create a dataset within mpcstore for myself. In the left navigation pane I'll go to Storage > Volumes > /mnt/mpcstore and select Create ZFS Dataset. I'll call it "nedstore" and give it an unlimited quota **(image B)**.



Create ZFS dataset in mpcstore

Dataset Name	nedstore
Compression level	Inherit
Enable atime	● Inherit ○ On ○ Off
Quota for this dataset	0
Quota for this dataset and all children	0
Reserved space for this dataset	0
Reserved space for this dataset and all children	0

3

ADD USERS AND GROUPS

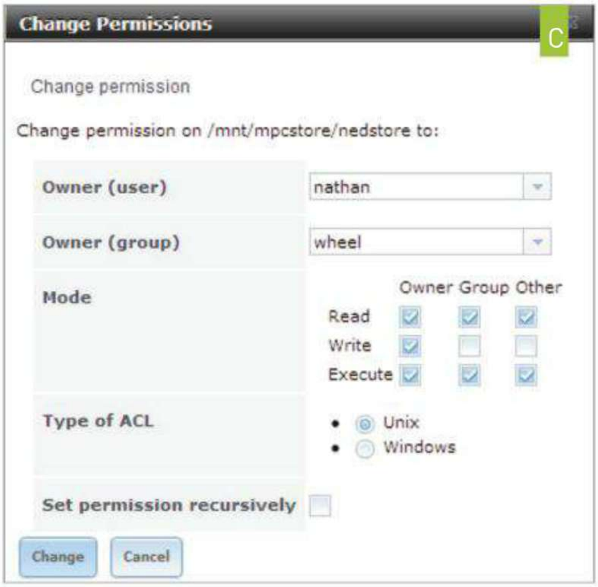
FREENAS can be configured to inherit users from an Active Directory or LDAP, but I'm assuming that this device will be used in an unmanaged home network, so we'll assign users with the same names as the Windows login names they use, per FreeNAS's instructions.

I've created a user named Nathan (for myself), and selected "Create a new primary group for the user," which will let me fine-tune permissions. I set my home directory to the dataset I created earlier, i.e., /mnt/mpcstore/nedstore.

4

CONFIGURE PERMISSIONS

GO BACK into Volumes and find the dataset you created earlier—in my case, that's nedstore. Click Change Permissions and select the user you just created. Here you can control which users and groups have read/write access to the dataset **(image C)**. Repeat the dataset, user, and permission steps for any users you create.



Change permission

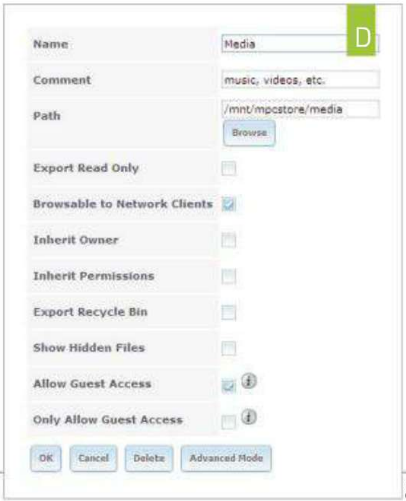
Change permission on /mnt/mpcstore/nedstore to:

Owner (user)	nathan
Owner (group)	wheel
Mode	Owner Group Other Read ☑ ☑ ☑ Write ☑ ☐ ☐ Execute ☑ ☑ ☑
Type of ACL	● Unix ○ Windows
Set permission recursively	☐

5

SET UP A MEDIA SHARE

I'M GOING TO SET up a media dataset so I can share my music and movies with the rest of the Windows computers in my network. Follow the procedure above for setting up a new dataset (I called it Media), then browse in the navigation pane to Sharing > Windows (CIFS) > Add Windows (CIFS) Share. Create a new share and point it to the dataset you've just created **(image D)**. You can either restrict it to specific users or groups, or enable an anonymous Guest Mode. If you have Apple computers on your network, you should also turn on AFP; if you have Linux, enable NFS. You can also enable SSH, rsync (for replication), iSCSI, and more, all from the Services panel.

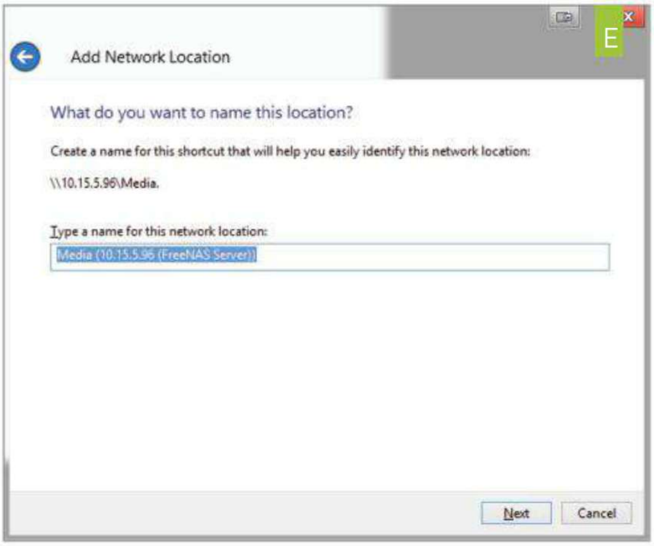


Name	Media
Comment	music, videos, etc.
Path	/mnt/mpcstore/media
Export Read Only	☐
Browsable to Network Clients	☑
Inherit Owner	☐
Inherit Permissions	☐
Export Recycle Bin	☐
Show Hidden Files	☐
Allow Guest Access	☑
Only Allow Guest Access	☐

6

MAP THE DRIVE

NOW YOU can map the Windows share you've just created. Go to My Computer, right-click, and select Add Network Location. Plug in the IP (the same one in your web console) and share name, as shown in the image **(image E)**. Give it a fancy name. Note that you'll have to configure permissions so that users have write access if you want to be able to add files and folders via Explorer.



What do you want to name this location?

Create a name for this shortcut that will help you easily identify this network location:

\\10.15.5.96\Media.

Type a name for this network location: Media (10.15.5.96 (FreeNAS Server))

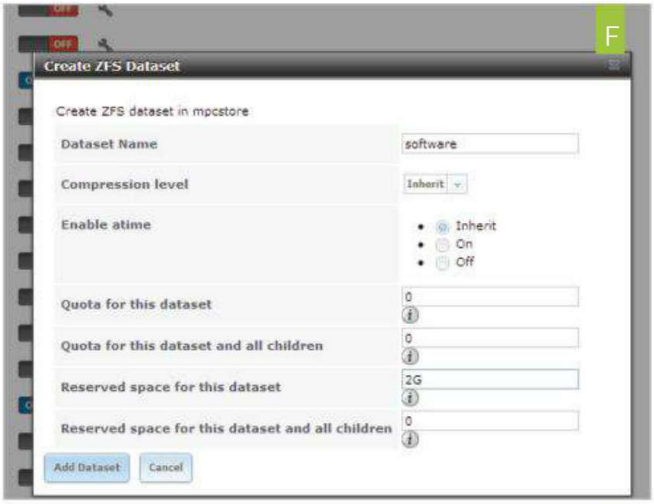
7

SET UP THE PLUGINS JAIL

EARLIER VERSIONS of FreeNAS contained robust streaming options, such as iTunes, uPnP, and BitTorrent clients. FreeNAS version 8.2 restored that functionality via the use of plugins. The word "plugin," however, dramatically overstates the ease of using these. To install and set up these plugins, first go to your storage volume and create two ZFS datasets, one of at least 2GB called Jail and another called Software **(image F)**. The plugin system basically creates a virtualized FreeBSD system inside your FreeNAS system, and by this point if you're tearing your hair out, you're not alone.

Next, go back to SourceForge and find the plugins_Jail.pbi file for the release you're running. In our case, that's at http://sourceforge.net/projects/freenas/files/FreeNAS-8.2.0/RELEASE/x64/plugins/. Download the PBI file to your computer. Now click the little wrench icon next to Plugins in the Services menu. That'll put you through a three-part setup screen. The first one will give you a temporary place to store the PBI you're about to upload. I just used the root of my mpcstore. The second lets you set up the paths to your jail and software datasets. Point the plugins jail path to the jail dataset and the archive path to the software dataset **(image G)**. The third step is to upload the plugins jail PBI file from your desktop.

You'll also need to create a separate pingable IP address for the software jail, distinct from your FreeNAS IP address **(image H)**.



Create ZFS dataset in mpcstore

Dataset Name: software

Compression level: Inherit

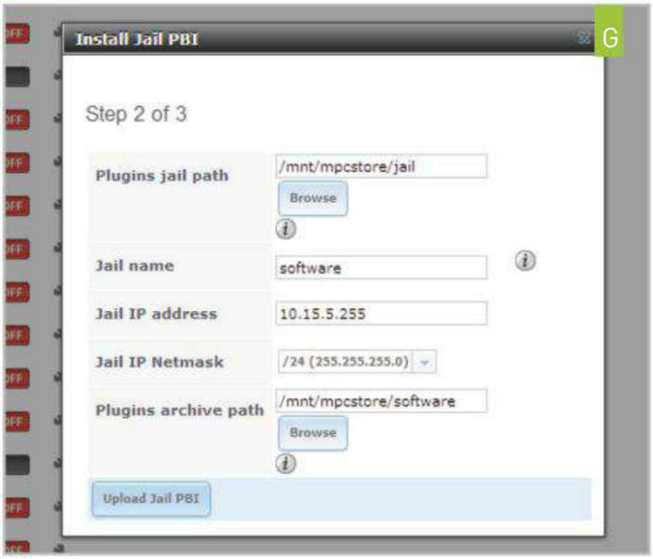
Enable atime: ● Inherit ○ On ○ Off

Quota for this dataset: 0

Quota for this dataset and all children: 0

Reserved space for this dataset: 2G

Reserved space for this dataset and all children: 0



Step 2 of 3

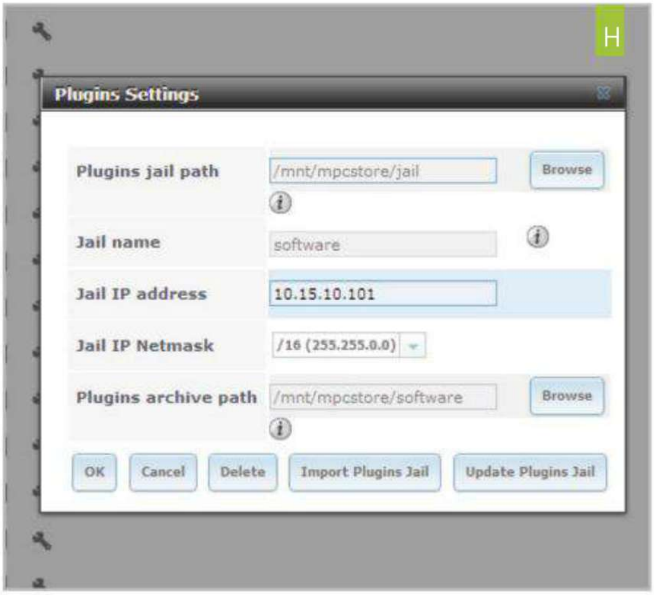
Plugins jail path: /mnt/mpcstore/jail

Jail name: software

Jail IP address: 10.15.5.255

Jail IP Netmask: /24 (255.255.255.0)

Plugins archive path: /mnt/mpcstore/software



Plugins jail path: /mnt/mpcstore/jail

Jail name: software

Jail IP address: 10.15.10.101

Jail IP Netmask: /16 (255.255.0.0)

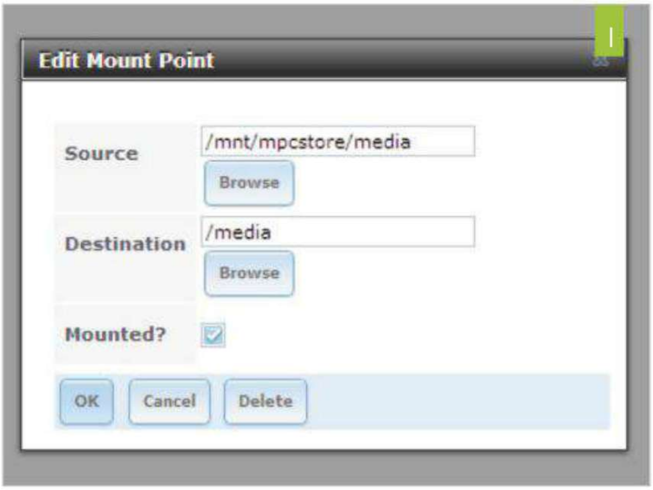
Plugins archive path: /mnt/mpcstore/software

8

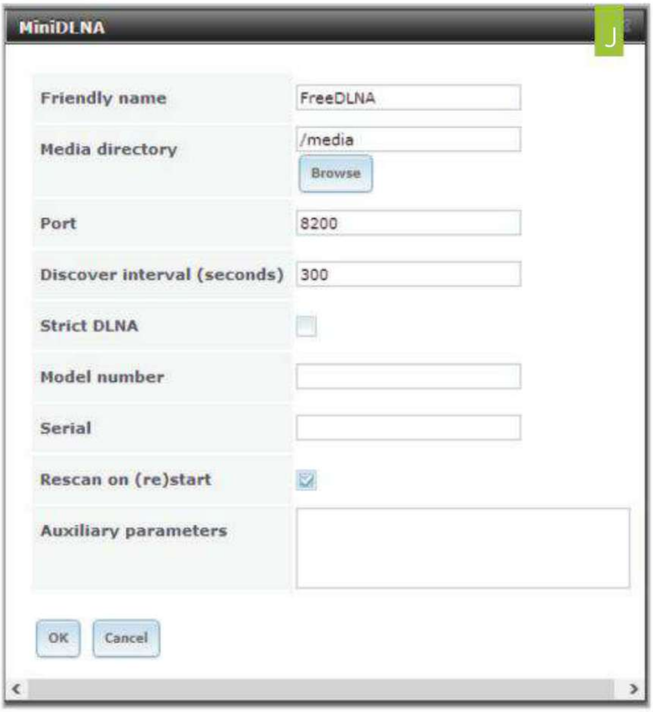
INSTALL PLUGINS

NOW YOU SHOULD be able to slide the Plugins slider to On and click the Plugins menu at the top. Go back to SourceForge and download the PBI files for the plugins you want to install. Right now the ones available are Transmission (a BitTorrent client), MiniDLNA (a, yes, DLNA client), and Firefly, a no-longer-maintained iTunes-library service. Once you've downloaded them, hit the Install Plugin button and browse to the PBI file and upload it. You'll see it appear in the Plugins list, with service status set to Off. Create a mount point *within* the jail pointing to a folder *outside* the jail **(image I)**. I directed it to the same dataset I'm using for my Windows share, so I can drag-and-drop media that can then be broadcast over MiniDLNA and Firefly. Easy, right?

Now go to the left-side navigation tree and go to Services > Plugins, and select the plugin you just installed. I'll use MiniDLNA as an example. Give it a friendly name and a media directory. Note that your media directory should use a relative path within your software jail, so it's best to just type it in manually. I used /media again **(image J)**. Save your changes and turn the plugin on. Make sure the IP address you picked for your software jail is working and you should see the DLNA server show up in your list of UPnP devices (I used VLC to check).



Source: /mnt/mpcstore/media
Destination: /media
Mounted? ☑



Friendly name: FreeDLNA
Media directory: /media
Port: 8200
Discover interval (seconds): 300
Strict DLNA: ☐
Model number:
Serial:
Rescan on (re)start: ☑
Auxiliary parameters:

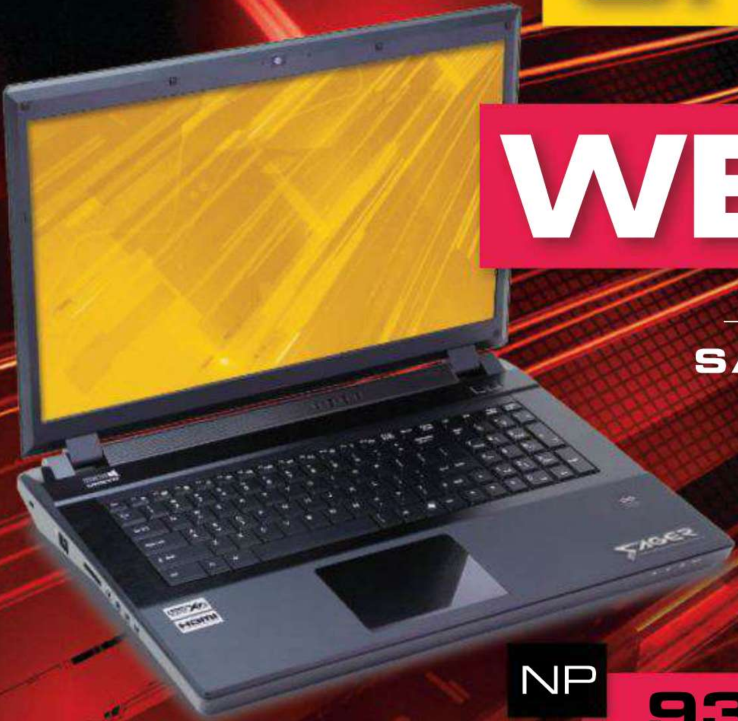
PADDLING IN THE SHALLOW END

SO NOW YOU know how to set up users, groups, datasets, and sharing, and you've got your plugins ready to go. We've only scratched the surface of what FreeNAS has to offer. Fortunately, there's a robust community that loves documentation and has its own forum with discussions and FAQs for every part of the FreeNAS experience, from hardware to software to plugins to fine-tuning, and more (bit.ly/OosjiB).

One note: Be sure to back up your NAS data to an external drive. Even with two-disk loss tolerance, you never know when disaster will strike. You can use FreeNAS's built-in rsync to make sure you have all your data synched to an external drive.

As for the specific hardware I used, it's probably overkill for most home users. It did enable large-file read and write speeds of over 90MB/s, which is quite nice.

FreeNAS's greatest strength is also its greatest weakness: It's incredibly complex and granular, with myriad configuration options, plugins, services, and so forth. The average home user may be better off buying an off-the-shelf NAS from Qnap or Synology, which are easier to configure and often include mobile access apps. But if you have the patience and the inclination, there's nothing like building your own.



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HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

ALEX CASTLE
CONTRIBUTING EDITOR

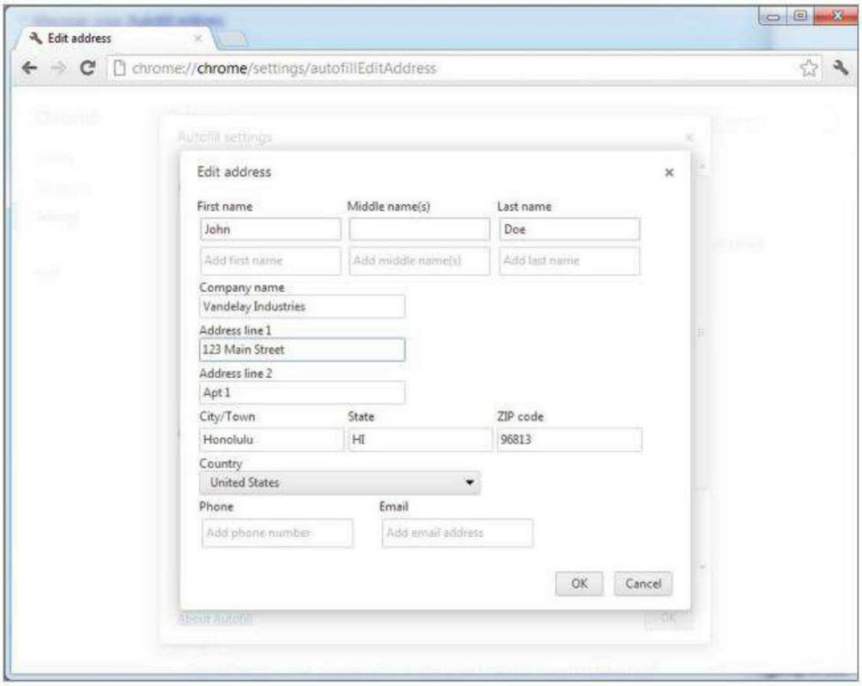
DO YOU REALLY NEED SYNC?

LATELY I'VE been thinking a lot about cloud storage, and I've realized something interesting: For a lot of people, a file-sync program like Dropbox might not be the best choice. I've personally been a big proponent of sync, but it's got a few drawbacks.

For one, to use Dropbox, you have to have an extra process running on your PC at all times, and if there's one thing I love more than file sync, it's an empty process manager. Second, for a lot of people sync is simply unnecessary. If you only use one computer, or you don't have a lot of files you need instant access to from anywhere, you probably don't need it.

Of course, your data should still be safe in the cloud—I'm just saying that scheduled online backup could be a better choice. You can get much better per-gigabyte pricing with a non-syncing service like Mozy, Carbonite, or even Amazon's business-oriented S3.

WINDOWS TIP OF THE MONTH



Edit address

chrome://chrome/settings/autofillEditAddress

Edit address

First name: John
Middle name(s):
Last name: Doe

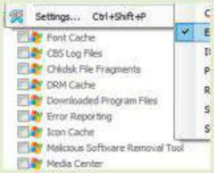
Company name: Vandelay Industries
Address line 1: 123 Main Street
Address line 2: Apt 1
City/Town: Honolulu
State: HI
ZIP code: 96813
Country: United States
Phone: Add phone number
Email: Add email address

CUSTOMIZE YOUR CHROME AUTOFILL

If you're frustrated with Chrome getting your "Autofill" personal information wrong, or suggesting out-of-date address and credit card info, you can manually edit the information. You can find it in the Chrome Settings menu if you click Show Advanced Settings. Look under Passwords and Forms for the link marked Manage Autofill Settings.

MAKE - USE - CREATE

91
Mount a SkyDrive Virtual Drive



92
Clean Up Your Cluttered Hard Drive

93
Back Up Your Cloud Storage Accounts

94
Use Your Fave Admin Tools in Windows 8

↘ submit your How To project idea to: comments@maximumpc.com

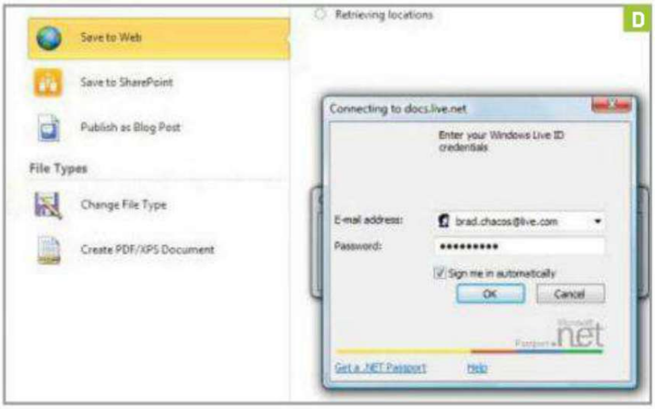
Mount a SkyDrive Virtual Drive

—Brad Chacos

ACCESSING YOUR DATA from virtually anywhere is easier than ever thanks to the rise of the cloud. Microsoft's SkyDrive provides a ridiculous 25GB of free storage, which is way more than the competitors, but accessing files using its web-based interface can be tedious, to put it nicely. We'll show you how to map your SkyDrive account as a network drive, which makes saving files to SkyDrive as simple as saving files to your C: drive. As a bonus, your Windows 7 PC won't be left out of the loop when Windows 8 and its built-in SkyDrive integration hit the streets later this year.

1 DISCOVERING YOUR SKYDRIVE'S URL You'll need a free Windows Live account and a copy of Microsoft Office 2010 to pull this off, so if you don't have those, go get them and then come back! (The trial version of Office works just fine if you don't feel like spending $100 for the full-blown suite.) Make sure to activate your SkyDrive by going to skydrive. live. com. Next, open an Office document, then select File > Save & Send > Save to Web > Sign In (to SkyDrive). Sign in with your Windows Live ID and password when prompted **(image D)**.

» You'll see a list of the folders in your SkyDrive. Pick any one, then click Save As. Don't be surprised if your PC freaks out and tosses up a "Not Responding" message here; just wait it out. Eventually a dialog box pops up. See the list of folders on the left side? Click the one that looks like a long string of letters and numbers—that's your main SkyDrive folder. A URL appears in the address bar at the top of the screen. Copy it, then close any open Microsoft Office documents.


D
Retrieving locations
Save to Web
Save to SharePoint
Publish as Blog Post
File Types
Change File Type
Create PDF/XPS Document
Connecting to docs.live.net
OK
Cancel
Passport .net
Get a .NET Passport
Help

Enter your Windows Live ID credentials

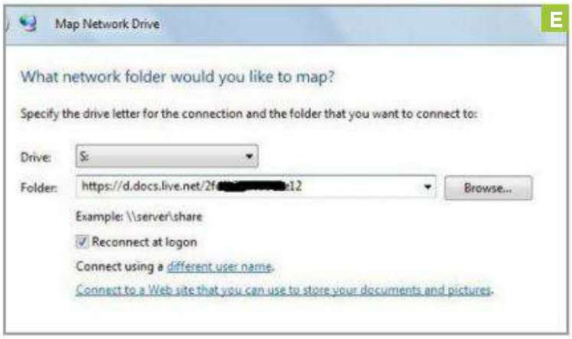
E-mail address: brad.chacos@live.com

Password: ●●●●●●●●●

☑ Sign me in automatically

2 MAPPING SKYDRIVE AS A NETWORK DRIVE Now it's just a simple matter of mapping your SkyDrive the way you would any other network drive. Bring up the Start menu and right-click Computer, then select "Map network drive." Paste the SkyDrive URL into the Folder field, then choose a letter for the network drive. (We like "S," for SkyDrive.) Check the "Reconnect at login" box, then click "Connect using a different user name" and re-enter your Windows Live ID information. Click Finish to, well, finish **(image E)**.

» Your SkyDrive folder appears as a network drive, complete with its Documents, Music, Public, and Pictures subfolders.


E
Map Network Drive
Browse...

What network folder would you like to map?

Specify the drive letter for the connection and the folder that you want to connect to:

Drive: S:

Folder: https://d.docs.live.net/2f[redacted]12

Example: \\server\share

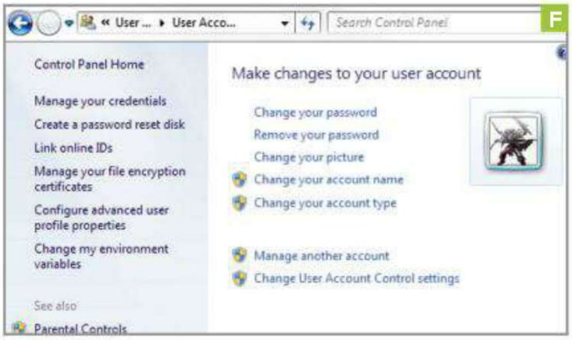
☑ Reconnect at logon

Connect using a different user name.

Connect to a Web site that you can use to store your documents and pictures.

3 LINKING YOUR WINDOWS LIVE ID WITH YOUR WINDOWS USER ACCOUNT Theoretically, that's it, but in actuality you'll need to manually reconnect to Windows Live every time you reboot your computer. Linking your Windows Live ID with your Windows 7 user account bypasses that hassle.

» Crack open the Start menu one more time and find the User Accounts settings in the Control Panel. You'll see a "Link online IDs" option on the left side of the window **(image F)**. Just click that, and Windows will hold you by the hand the rest of the way. Be sure to sign in with the same Windows Live ID associated with the network-mapped SkyDrive account!


F
« User ... ▸ User Acco...
Search Control Panel
Control Panel Home
Manage your credentials
Create a password reset disk
Link online IDs
Manage your file encryption certificates
Configure advanced user profile properties
Change my environment variables
See also
Parental Controls
Change your password
Remove your password
Change your picture
Change your account name
Change your account type
Manage another account
Change User Account Control settings

Make changes to your user account

QUIRKS OF A NETWORK-MAPPED SKYDRIVE

Remember that although your SkyDrive appears to reside on your computer, it still lives in the cloud; as such, you'll need to download/upload files you want to open or save, which obviously requires an active Internet connection. Uploads are just as slow as they are using the web-based interface, and individual files have a 100MB cap. Also, the Properties option for mapped SkyDrives shows incorrect storage information, so you'll need to hop online and check out your remaining space allotment every now and then.

Clean Up Your Hard Drive with DrivePurge

YOU'LL NEED THIS

DRIVEPURGE
A free, portable hard drive cleaning utility from bit.ly/nmBRSL.

ALTHOUGH HARD DRIVES are now bigger and cheaper than ever, you may be surprised by just how much unnecessary garbage is cluttering yours. While the chances of running out of space are lower than they have been in the past, an untidy hard drive is still less efficient than a neat one, and can slow down the overall performance of your computer.

DrivePurge is a fantastic, free maintenance tool that will not only tidy up all the unwanted files that accumulate over time, but can also help protect your privacy by cleaning up the data stored in your PC's log files and registry. You'll be amazed at how much useless data is filling up your hard drive! Try the tool out for yourself to see how much space you can save. –**MARK WILSON**

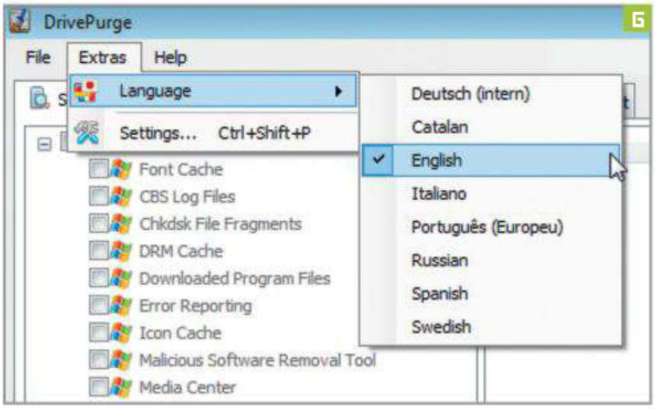
1 **DOWNLOAD AND INSTALL** For the download, navigate to www.gaijin.at/en/dldrivepurge.php. Beneath the Download heading, click Download. DrivePurge is provided as a compressed RAR file—on the off chance that you don't already have a program capable of extracting .rar files, we recommend 7-Zip, available for free at www.7-zip.org/.

» Extract the DrivePurge RAR. The program doesn't require an install, so you'll be able to run the executable directly from the folder you extracted to. Right-click it and select Run as Administrator to get started with the program.

2 **CONFIGURE DRIVEPURGE** Click Yes in the User Account Control dialog and DrivePurge will load. It will start in German mode at first, so select the Extras menu and then click Sprache / Language followed by English **(image G)**.

» Click OK and then close and restart the program in the same way to activate the new setting.

» Before deleting any files, click the Extras menu and select Settings. Now move to the System Cleanup tab and check the box labeled "Move files to the Recycle Bin (if possible)" before doing the same on both the Drive Cleanup and User Tracks Cleanup tabs. Click OK when this is done.

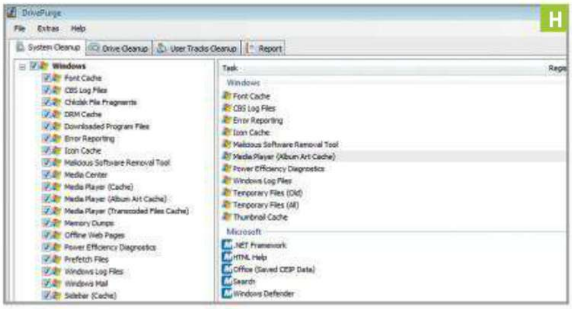

G
DrivePurge
File
Extras
Help
Language
Settings... Ctrl+Shift+P
Deutsch (intern)
Catalan
English
Italiano
Português (Europeu)
Russian
Spanish
Swedish
Font Cache
CBS Log Files
Chkdsk File Fragments
DRM Cache
Downloaded Program Files
Error Reporting
Icon Cache
Malicious Software Removal Tool
Media Center

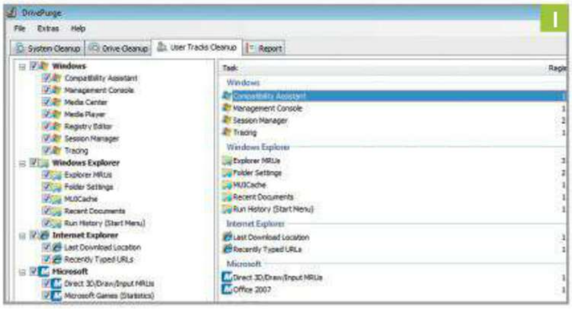
3 **CLEAN UP YOUR SYSTEM** On the System Cleanup tab, check the boxes to the left of the Windows, Microsoft, and Applications labels to select all of the options, and then click the Analyze button at the bottom of the screen. When the results of the drive search are shown **(image H)**, click the Cleanup button to the bottom right, followed by OK to delete them.

» If you change your mind about deleting a particular item in the list, you can right-click its name and select the Remove Job option. Once this is done, you're ready to move to the Drive Cleanup tab.

» To the left of the screen you'll see a list of all the hard drives inside your computer. Check each of them, make sure that All is selected from the drop-down menu to the right, and check all of the boxes below. Click Analyze, and once the scan has been performed click Cleanup followed by OK. Now move to the User Tracks Cleanup tab to protect your privacy.

» In addition to saving space, DrivePurge can also be used to protect your privacy by cleaning up traces of your past activities. In the same ways as before, you can check all or just some of the boxes on the left **(image I)** before clicking Analyze and then Cleanup, this time to remove logs stored by programs. Work through these tabs on a regular basis to free up space and clean logs.


H
DrivePurge
File
Extras
Help
System Cleanup
Drive Cleanup
User Tracks Cleanup
Report
Windows
Font Cache
CBS Log Files
Chkdsk File Fragments
DRM Cache
Downloaded Program Files
Error Reporting
Icon Cache
Malicious Software Removal Tool
Media Center
Media Player (Cache)
Media Player (Album Art Cache)
Media Player (Transcoded Files Cache)
Memory Dumps
Offline Web Pages
Power Efficiency Diagnostics
Prefetch Files
Windows Log Files
Windows Mail
Sidebar (Cache)
Task
Windows
Font Cache
CBS Log Files
Error Reporting
Icon Cache
Malicious Software Removal Tool
Media Player (Album Art Cache)
Power Efficiency Diagnostics
Windows Log Files
Temporary Files (Old)
Temporary Files (All)
Thumbnail Cache
Microsoft
.NET Framework
HTML Help
Office (Saved CEIP Data)
Search
Windows Defender


I
DrivePurge
File
Extras
Help
System Cleanup
Drive Cleanup
User Tracks Cleanup
Report
Windows
Compatibility Assistant
Management Console
Media Center
Media Player
Registry Editor
Session Manager
Tracing
Windows Explorer
Explorer MRUs
Folder Settings
MUICache
Recent Documents
Run History (Start Menu)
Internet Explorer
Last Download Location
Recently Typed URLs
Microsoft
Direct 3D/Draw/Input MRUs
Microsoft Games (Statistics)
Task
Windows
Compatibility Assistant
Management Console
Session Manager
Tracing
Windows Explorer
Explorer MRUs
Folder Settings
MUICache
Recent Documents
Run History (Start Menu)
Internet Explorer
Last Download Location
Recently Typed URLs
Microsoft
Direct 3D/Draw/Input MRUs
Office 2007

Back Up Your Cloud Storage with GoodSync

YOU'LL NEED THIS

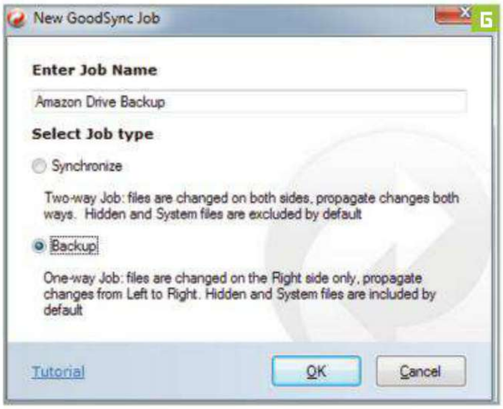
GOODSYNC
This cloud storage backup software is available in free and paid versions at www.goodsync.com.

WITH SO MANY CLOUD storage services available to you, you don't ever truly need to pay for online storage. When your 2GB Dropbox runs out, you can always get 5 free gigs from Amazon. When that runs out, why not open up a SkyDrive account for an additional 7GB? The only problem with this plan is that your files get spread out over different services, which can make it harder to find things, and can also increase your exposure to risk of losing access to files during service outages. In this article, we'll show you how to mitigate both of these problems, by using GoodSync to keep an up-to-date local backup of all the files on multiple cloud storage services. –ALEX CASTLE

1 INSTALL GOODSYNC

INSTALL GOODSYNC You can find the GoodSync software available for free at www.goodsync.com. The free version does have some limitations—notably on the quantity of files that can be backed up—but it can be used indefinitely and is at least a good way to judge whether the full version is worth $30 to you.

» Download the file and run the installer. There's nothing much to configure during the installation; just see it through to the end and you'll be asked to name your first job. GoodSync organizes all of your syncing tasks into jobs; each job consists of two locations to sync, which can be on your hard drive, USB, or network storage, or even on the cloud (**image G**).



Enter Job Name

Amazon Drive Backup

Select Job type

○ Synchronize

Two-way Job: files are changed on both sides, propagate changes both ways. Hidden and System files are excluded by default

● Backup

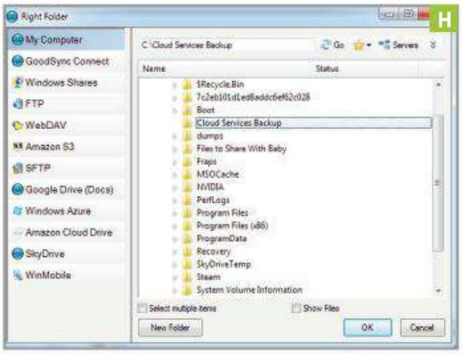
One-way Job: files are changed on the Right side only, propagate changes from Left to Right. Hidden and System files are included by default

2 PICK YOUR BACKUP LOCATIONS

PICK YOUR BACKUP LOCATIONS One of the major advantages of GoodSync over a simpler sync application like SyncToy is the ability to connect directly to several of the most popular cloud storage services. If you use cloud storage from Google, Amazon, or Microsoft, you can set up a job that backs them up directly. To do so, just click the Browse button next to the left location field, and in the menu that pops up, select the service you want to connect to. Enter your login credentials and click Go to connect to the service and see a list of folders to sync.

» GoodSync can't connect directly to Dropbox, but it's still easy to back up those files using the software, as long as you have the Dropbox client installed on your PC. Simply click the Browse button, and select My Computer to browse to the location of your My Dropbox folder.

» Next, click the Browse button next to the right-side location field. This time, in the popup window select the location where you want your backup files to be stored. You can click My Computer and choose a local location (**image H**), or select Windows Shares or FTP to select a network location.



C:\Cloud Services Backup

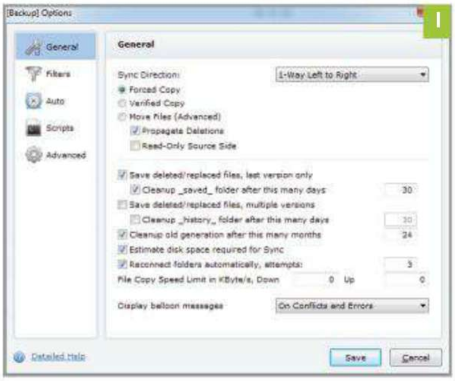
$Recycle.Bin
7c2eb101d1ed8addc6ef62c028
Boot
Cloud Services Backup
dumps
Files to Share With Baby
Fraps
MSOCache
NVIDIA
PerfLogs
Program Files
Program Files (x86)
ProgramData
Recovery
SkyDriveTemp
Steam
System Volume Information

☐ Select multiple items
☐ Show Files

3 SCHEDULE YOUR BACKUP

SCHEDULE YOUR BACKUP Once you've specified both the left- and right-hand locations, you just have to tell GoodSync how to transfer files between them. To do this, click the small icon in the upper-center of the GoodSync window with a picture of two green arrows. In the window that opens (**image I**) click the Sync Direction to back up from the cloud account to your local location, not vice-versa.

» Finally, click the Auto tab in the backup options window to select how often GoodSync will automatically back up. Unless you need to know that your files are instantly backed up, we recommend conserving system resources by scheduling a backup every two hours or more.



General

Sync Direction: 1-Way Left to Right
● Forced Copy
○ Verified Copy
○ Move Files (Advanced)
  ☑ Propagate Deletions
  ☐ Read-Only Source Side

☑ Save deleted/replaced files, last version only
  ☑ Cleanup _saved_ folder after this many days 30
☐ Save deleted/replaced files, multiple versions
  ☐ Cleanup _history_ folder after this many days 30
☑ Cleanup old generation after this many months 24
☑ Estimate disk space required for Sync
☑ Reconnect folders automatically, attempts: 3
File Copy Speed Limit in KByte/s, Down 0 Up 0

Display balloon messages: On Conflicts and Errors

Access Your Favorite Admin Tools in Windows 8

YOU'LL NEED THIS

WINDOWS 8
Microsoft's latest OS is available at http://windows.microsoft.com/is-IS/windows-8/download.

YOU HAVE TO ADMIT, Microsoft has taken a sizeable gamble with the design of Windows 8. Some commentators say the company simply has to change the way it operates if it wants to gain any traction in the tablet and smartphone market, and with the new operating system's touch-oriented model, it has certainly started down that path. The Windows interface has undergone a radical rethink in terms of both operation and interactivity.

For us desktop users, it represents a massive change from what we've become accustomed to over the years. Gone is the desktop as we've come to know it and, most jarringly of all, gone is the Start menu that we've come to love since the heady and somewhat dysfunctional days of Windows 95.

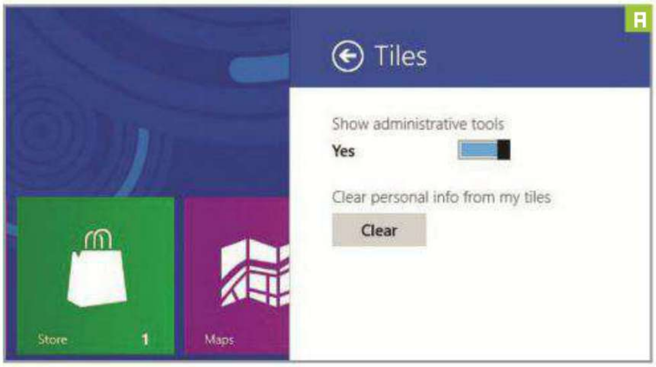
But there's no need to worry—all we're looking at with Windows 8 is essentially a re-skinned version of Windows 7 with some fancy new GUI components dropped in on top of it. As Microsoft itself says in the reviewer's guides it sent out to the media: It's Windows 7, only better.

In this how-to, we'll show you how to access all the administrative features and tools you've come to rely on, in Windows 8. –DAVE JAMES

1 **UNLOCK THE ADMIN TOOLS** On the new Windows 8 Start screen, start by bringing up the Charms bar from the right-hand side of the screen and clicking Settings. Then select the Tiles menu and slide the bar that says "Show administrative tools" to the right (image A). Now just tap anywhere on the main screen to remove the Charms bar, and the full set of administrative tools will be displayed.

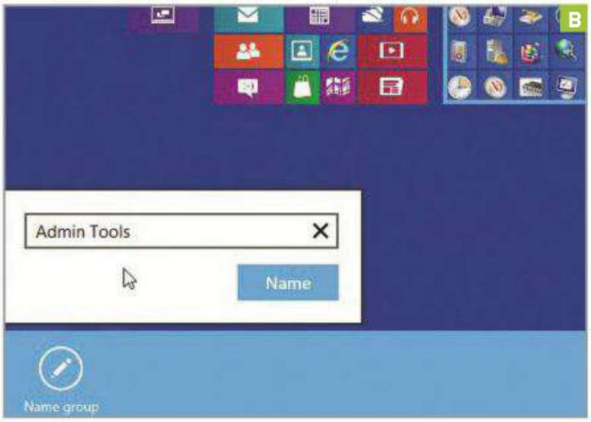
» When these tools appear, they may be mixed in with various other shortcuts, but we'll show you how to tidy them up. You can group icons together on the Start screen with a few clicks. First, minimize the icons by hovering the mouse over the bottom right corner and clicking the minus symbol. You can now see the individual groups by right-clicking them.

» When you right-click, a bar will appear at the base of the screen giving you the option to name the group. Once you've entered a name here (image B), you can zoom back into the Start screen and move individual icons between groups. Return to the minimized view and you can move entire groups around by dragging and dropping them into your preferred place.



Show administrative tools
Yes

Clear personal info from my tiles

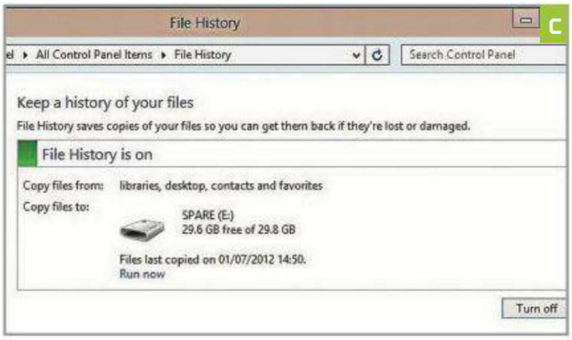


Admin Tools

2 **SET UP AUTOMATED BACKUP** One of the most important administrative features in any OS is file backup, and Windows 8 makes it easier than ever to quickly protect all your important files. The new File History app lets you select a device to use for automatic backups for your desktop and Libraries. First, enter the Control Panel and start File History.

» If you haven't plugged in your USB stick or other storage device, now is the time to do so. The drive will appear in the window, and File History will be switched off. Click "Turn on" to begin syncing your content to the drive (image C). You can exclude a particular folder by selecting it in the "Exclude folders" option, and add Libraries by creating new ones and filling them with folders (image D).

» The advanced settings will let you specify how long to keep outdated versions of files, and how often to back up the whole lot. If you delete a file from your main drive that you then need to back up, you can use Restore Personal Files to select an appropriate restore point. You can even drill down through the backups to see which files are in each option.


File History
C
All Control Panel Items ▸ File History
Search Control Panel
Turn off

Keep a history of your files

File History saves copies of your files so you can get them back if they're lost or damaged.

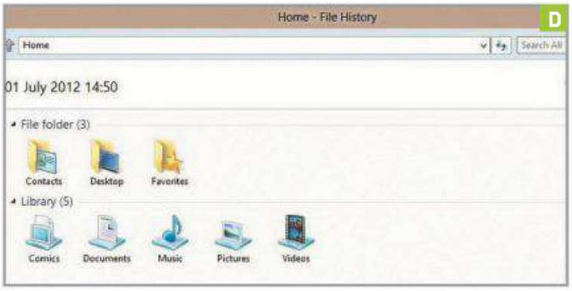
File History is on

Copy files from: libraries, desktop, contacts and favorites

Copy files to: SPARE (E:) 29.6 GB free of 29.8 GB

Files last copied on 01/07/2012 14:50.

Run now


Home - File History
D
Home
Search All
01 July 2012 14:50
File folder (3)
Contacts
Desktop
Favorites
Library (5)
Comics
Documents
Music
Pictures
Videos

3 FIND FAMILIAR MENUS AND FEATURES

All your favorite system tools from earlier versions of Windows are still present, but they may have moved or gotten a face-lift. Here's a "Where are they now?" look at six key Windows admin tools.

STARTUP

It was once hidden within the murky depths of msconfig, but the Startup tab has received a promotion and found itself a home in the new Task Manager. It still has the same level of functionality as before, allowing you to customize which programs load when you boot your machine, but it's now much easier to access than before. You can also travel directly to the file location to see a rundown of the impact it has on your boot time.

PERFORMANCE

This is another example of the improvements Microsoft has made to the Task Manager, and will be of particular interest to power users. Previously, the main screen on the Performance tab only displayed a graph of your machine's CPU usage, with a little extra detail about memory. Now, there's information about everything from processor speed to the read and write speeds of your drives. This provides a comprehensive idea of how your machine is performing (**image E**).

SYSTEM INFORMATION

If you don't necessarily want to know how your machine is performing, but are looking for the details of your PC's components (from a software or hardware perspective), the System Information screen is the place for you. It will give you the full lowdown on every facet of your machine, from the drivers for your mouse to the layout of your drive partitions.

WINDOWS FIREWALL

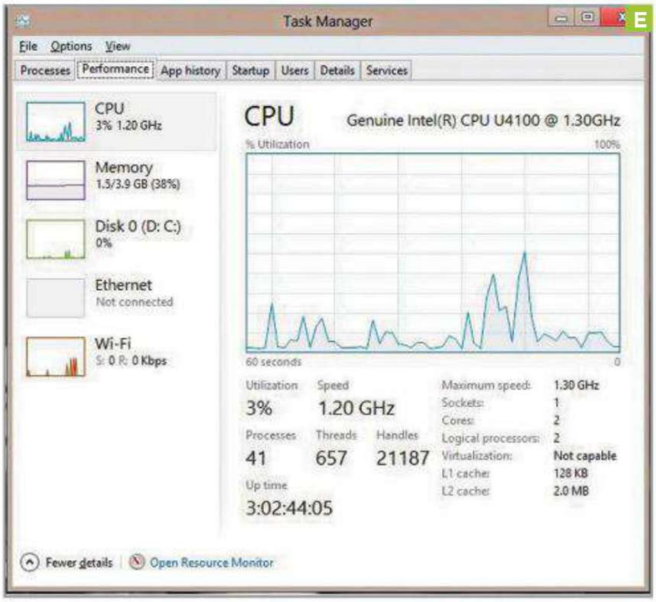
Nothing has really changed with the latest iteration of Windows Firewall and Advanced Security. It's still the place to go to fully customize your firewall settings, whether you want to import new exception policies or diagnose any kind of network/security problems. It also allows you to monitor how your current network connection is configured (**image F**).

BOOT INTO SAFE MODE

Boot times in Windows 8 have improved, but with an SSD installed as a boot drive, it can be tricky to boot into Safe Mode. Luckily, you can access it via Advanced Boot Options, which is accessible through the extra settings on the Charms bar. If you hit Advanced Startup under the General tab, the PC will restart into Windows 8's debug mode.

RESET WINDOWS 8

Your computer now has a function similar to the factory reset option on your smartphone, accessible via the PC Settings screen on the Charms bar. It gives you two options—you can either refresh the PC without losing any of your personal files (such as photos and music), or you can perform a total system reset, which will revert your PC to its original state. ⏻


Task Manager
E
File
Options
View
Processes
Performance
App history
Startup
Users
Details
Services
CPU
3% 1.20 GHz
Memory
1.5/3.9 GB (38%)
Disk 0 (D: C:)
0%
Ethernet
Not connected
Wi-Fi
S: 0 R: 0 Kbps
% Utilization
100%
60 seconds
0
Fewer details
Open Resource Monitor

CPU Genuine Intel(R) CPU U4100 @ 1.30GHz

Utilization 3%

Speed 1.20 GHz

Processes 41

Threads 657

Handles 21187

Up time 3:02:44:05

Maximum speed: 1.30 GHz

Sockets: 1

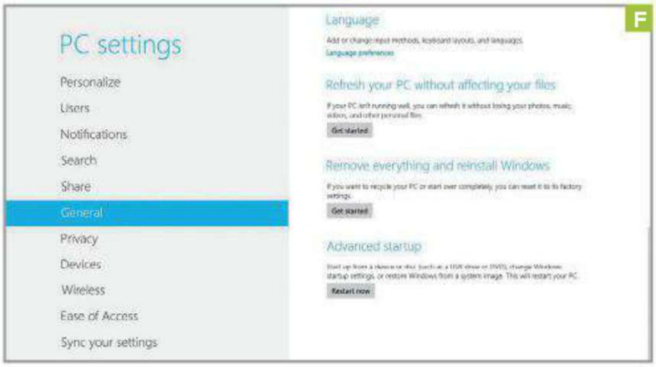
Cores: 2

Logical processors: 2

Virtualization: Not capable

L1 cache: 128 KB

L2 cache: 2.0 MB


F
PC settings
Personalize
Users
Notifications
Search
Share
General
Privacy
Devices
Wireless
Ease of Access
Sync your settings
Language preferences
Get started
Get started
Restart now

Language

Add or change input methods, keyboard layouts, and languages.

Refresh your PC without affecting your files

If your PC isn't running well, you can refresh it without losing your photos, music, videos, and other personal files.

Remove everything and reinstall Windows

If you want to recycle your PC or start over completely, you can reset it to its factory settings.

Advanced startup

Start up from a device or disc (such as a USB drive or DVD), change Windows startup settings, or restore Windows from a system image. This will restart your PC.

THE LIST

6 CONVENTIONS ALL NERDS MUST ATTEND ONCE

6 COMIC-CON

The big studios have moved in, but if you want cosplay mixed with gaming, sci-fi, and a healthy dose of comics, Comic-Con continues to be a must-make pilgrimage for nerds.

5 PAX

The Penny Arcade Expo (PAX) has developed into *the* celebration of all things gaming and a crush of nerdmanity, too.

NINTENDO DS

4 CAX

Take a couple hundred coin-ops, rent out a convention center, and you get the yearly arcade convention known as California Extreme, or CAX. Best part: All machines are set on Free Play.

Image credit: numb3r

3 THE STAR TREK CONVENTION, LAS VEGAS

What happens on Ceti Alpha V, stays on Ceti Alpha V.

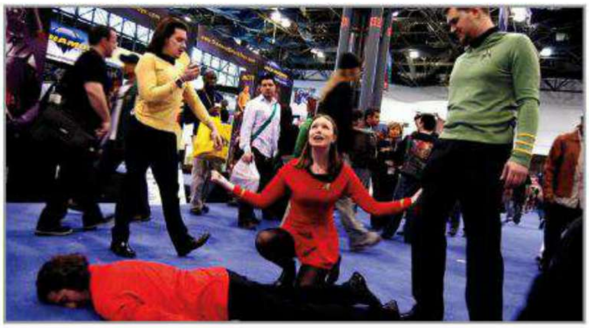


Image credit:Mild Mannered Photographer

2 DRAGON*CON

Southern nerds who still won't travel north or west because of Sherman's March should consider Dragon*Con.

Image credit: VladeB

1 MAKER FAIRE

Robotics—both real and in mock-up R2 units—make this the thinking nerd's con.

Image credit: Istolethetv

ZALMAN
COOL INNOVATIONS

ATX MID Tower Computer Case Series

ZALMAN
MS800
ZALMAN
Z12 PLUS

MS800 Series

- Dash board style user-centered design
- Multi guide provided to prevent VGA card from bending and for installation of additional fans
- Provided 6-channel multi fan controller
- Support HDD hot swap bay (MS800 Plus Only)

Z12 Series

- Wide band front mesh ventilation structure
- Maximized airflow – user can install up to 6 fans
- Provided multi fan controller(Z12 Plus Only)

facebook.com/zalmanusa
www.zalman.com

NC2000 NT

CNPS9900 DF

LQ SERIES (310/315/320)

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amazon.com — www.amazon.com
TigerDirect.com — www.tigerdirect.com
Fry's Electronics — www.fryselectronics.com
MICRO CENTER computers & electronics — www.microcenter.com
NCIX.com — www.ncix.com
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